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AN EXAMINATION OF MOTOR CARRIER OPERATIONS IN THE MACKENZIE VALLEY AREA

by

Ⓒ DAVID REED PODMORE

A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES
AND RESEARCH IN PARTIAL FULFILMENT OF THE
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EDMONTON, ALBERTA

SPRING, 1974

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled An Examination of Motor Carrier Operations in the Mackenzie Valley Area submitted by David Reed Podmore in partial fulfilment of the requirements for the degree of Master of Arts.

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Date ..April 15, 1971....

ABSTRACT

The development of new transportation technology, and the improvement and refinement of traditional transportation modes have made the rapid development of our northern lands possible. As the pace of northern expansion accelerates, an understanding of each facet of northern transportation is essential to ensure the wise development and protection of all northern resources.

The gradual evolution of a complex system of all-weather and winter roads in the Mackenzie Valley Area has helped to determine the nature of the region's economic, resource, and community development. The object of this thesis is to consider the role of land transportation in the economic development of the Mackenzie Valley, and, in particular, to examine the increased importance of common and contract motor carrier transportation in the area.

The study area is defined as the Mackenzie Valley Area, and is roughly delimited as the area included within the Mackenzie River drainage basin. The region, as defined in the thesis, also includes most of northern Alberta as far south as Edmonton, since the major rail and road

transportation systems which connect the Mackenzie Valley with the South originate in the Edmonton area.

The thesis required the collection of data from transport companies operating in the region, the customers served, and existing library and government sources. Research involved an examination of transportation costs over winter and conventional roads in the northern study area, identification of the industries served by northern motor carriers, determination of the type and volume of goods transported and an analysis of the rate structure of northern trucking operations. As well, the importance of intermodal shipping operations, and government regulation of motor carriers in the Mackenzie Valley are considered.

Transportation is recognized as the key to northern development. An accurate interpretation of present trends and future requirements based on reliable data is essential to decisions which may affect the direction and nature of northern development. This thesis provides fundamental statistical information and analyses of motor carrier operations in the Mackenzie Valley area during the 1972 operating season.

ACKNOWLEDGEMENT

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Special thanks are extended to Dr. William C. Wonders, my thesis supervisor, for his attention to detail, valuable criticism, and assistance during the preparation of the final draft. The participation of Dr. M. J. Hodgson, and Dr. W. D. Gainer on the masters committee was also greatly appreciated.

Mrs. Laura Zornes was very patient and understanding during the preparation of the typewritten manuscript. I am indebted to her for her professional and meticulous

efforts on my behalf.

Finally, the special contributions and continuous encouragement of three individuals should not be overlooked. To my wife, Janice, and my parents, Mr. and Mrs. J. W. Podmore, I offer my deepest appreciation for their support during my graduate studies.

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CHAPTER 1

INTRODUCTION

> *Transportation today, as always in the past, is a vitally important instrument in our nation's development.*[1]

During the past decade, interest in the development of Canada's northern territories has reached a new high. Excitement surrounds the activities of the northern mineral and hydrocarbon industries. Increased interest in Northern Canadian reserves has been catalyzed by an exponential increase in the world and domestic demand for precious metals and energy resources. Timely discoveries of crude oil reserves on the Tuktoyaktuk Peninsula, natural gas in the Mackenzie Delta, and substantial ferrous and non-ferrous mineral deposits in the Yukon and Northwest Territories have captured the popular imagination. A recent federal study concluded:

> *It is now confidently predicted that the mineral, oil, and gas resources likely to be found can form the basis of very substantial economic development.*[2]

The same report continues:

> *Longer range strategy must be seen in*

> *the light of economic development that can be realistically expected in the North. On purely economic grounds, development of non-renewable resources will occur as a result of demand for progressively scarcer raw materials.*[3]

Two major obstacles are slowing the rate of discovery and exploitation of new mineral resources in Northern Canada. First, the increased concern by Canadians for the protection and preservation of the northern environment have placed a heavier burden and greater responsibility on private developers. In short, "engineering must take full account of the ecological dimensions"[4] of any development proposal. Second, the primitive character[5] of surface transportation facilities in the North limits the ability of northern resource-based industries to enter national and international markets on a competitive basis. This latter point is of more immediate concern in northern motor-carrier operations.

For over a century northern transportation development has centred on the Mackenzie River and the Mackenzie Valley,[6] but by southern standards, many transportation facilities in the Valley are still poorly developed. Geography and economics limit the feasibility of major extensions to the marine, air, rail, or road systems in the Valley. Despite the limitations, improvements and additions to the network have been made in the past decade, and major developments are planned before 1980.[7] Most predictions of future demand and the ability of industry and government to meet the demands are optimistic. Rempel, of Imperial Oil, points out that:

> *With the present demand for resources.... transportation system proposals are usually not far behind resource discoveries.*[8]

Federal cabinet committees, Royal Commissions, and private development groups have conducted studies to determine the predicted growth of transportation requirements in the Mackenzie Valley. Unfortunately, few have based their predictions on reliable and comprehensive analysis of the demand placed on existing services and equipment.[9]

The Problem

In almost every major northern transportation study any determination of the present demand for motor-carrier transport has been particularly neglected, despite the proliferation of development plans for road extensions based on forecasts of future demand.[10] The gradual geographic extension of the Mackenzie Valley road network seems to have often been a result of high level political manoeuvring, rather than a rational selection of the optimum transportation alternative for each new region served.

As the rate of resource discovery and development accelerates, there is a pressing need for a complete analysis of the role the motor carrier is playing in the northern transportation industry today. This then, may be the special contribution of a thesis on northern motor-carrier operations -- to accurately determine the volume, nature, and commodity-mix of north and southbound traffic carried by truck transport in the Mackenzie Valley. Such a study should provide a reliable basis to assess the need for road improvements required to satisfy existing and short-term demands optimally.

The Approach

The approach is geographic. Transportation systems facilitate the movement and distribution of goods, services, people and information[11] in space at any given time. Geographic methods of analysis provide a systematic and logical means to identify the structural elements[12] of any transport system. In this thesis, the main emphasis is on the spatial processes associated with the development and utilization of the Mackenzie Valley land transportation system. Further, it seeks to explain areal variations in the demand for transportation services which exist in the Valley.

In recent years, a few estimates of the volume of traffic carried by truck in the Mackenzie Valley have been attempted, but the accuracy and validity of most estimates have been highly suspect. One of the major problems faced by transport analysts in their efforts to identify commodity flows has been the lack of any uniformity in the manner of data-collection and reporting in the Canadian motor-carrier industry.[13] In the Mackenzie Valley, difficulties of identifying the volume and nature of traffic flows are compounded by the fledgling character of northern motor carrier operations, and the highly competitive nature of the industry, especially on the Mackenzie and Yellowknife Highways.

Other factors also influence the reliability of any estimate of northern truck traffic. The physical environment places special restraints on the economic operation of motor carriers in the Canadian North, and affects the direction and volume of traffic moving by truck on a seasonal basis. External factors, especially major fluctuations in the world demand for energy and minerals, may cause greater variation in the volume and direction of freight movements in the Mackenzie Valley than is typical in other regions of Canada. The proportion of total traffic movements handled solely by motor carrier in the Valley often depends upon the proximity of existing trunk and arterial roads to proven resource properties and promising areas of exploration.[14]

The volume of freight carried by truck transport in the Valley also depends, in part, upon the competitive position of alternate transport modes, and the rate of development of more efficient technologies within the motor carrier industry and by competing modes. The location of transportation terminals and their proximity to the facilities and services of other transport systems, influence the intermodal[15] movement of traffic. Northern transportation studies are simplified by the immature character of existing systems, which at least partially determines the nature of intermodal shipments, and simplifies the task of delimiting market areas for each mode.

These special problems and unique characteristics of the northern transportation industry are emphasized here, since the techniques adopted in any effort to identify the volume, origin, destination, and commodity-mix of motor-carrier developments in the Mackenzie Valley must be tempered by consideration of these points, and a multitude of less obvious factors. The paucity of reliable statistics on northern freight movements, and the inconsistencies in the scattered data which do exist have necessitated the compilation of information from primary sources in the study area. Data gathered in the field were compiled in a manner to determine the influence of motor carrier operations on the geographic distribution of goods and services in the Valley. An effort has then been made to test the hypothesis that the factors mentioned above -- physical environment, proximity and access to major resource development areas, competition and coordination between alternate modes, and political situation -- represent unique circumstances in the northern motor-carrier industry, and will determine its long-range viability.

Data Collection and Methods of Analysis

Clients of northern common-carriers and independent operators were interviewed and questionnaires (Appendix B) were distributed in all major settlements accessible by road in the study area.[16] Particular attention was paid to variations in the commodity-mix and monthly receipt (or discharge) of truck shipments in each community. The relative importance of the trucking industry's share of total inbound and outbound shipments by all modes was determined on the basis of interview data gathered from major rail, marine and air freight operators in the settlements. As a double check on the final estimates of total shipments by all transportation modes to each community, questionnaire figures were compared to data obtained from the major common and contract carriers in the Mackenzie Valley. Interviews were also held with key personnel from the Northern Transportation Company Limited (marine), the Department of Transport (air), Great Slave Lake Railway, and several independent contract carriers who provide scheduled service or operate regularly in the Mackenzie Valley.

Because of the isolated nature of several resource and exploration and development centres, considerable data had to be obtained by correspondence. Generally, this proved to be a most satisfactory method for obtaining reliable information. The interview and questionnaire method was adopted for the settlements as the most expedient and practical method to obtain information from northern truck clients and operators, in the limited time available for field work.

Response to the client questionnaire was usually favourable but the rate-of-return varied significantly from settlement to settlement and seemed to reflect the relative level of concern for the high cost of northern shipping. Interest in the study seemed to be greatest in Yellowknife, Hay River, and Peace River, where about seventy per cent returns were achieved. In Fort Smith and Fort Simpson, less than twenty-five per cent of the questionnaires distributed were returned. Fort Smith and Fort Simpson have only been accessible by all-weather road in recent years.[17] It may be possible that local residents in these settlements have not yet appreciated the high increase in trucking costs since first service, so apparent to merchants and other clients in Yellowknife or Hay River.

The return on mailed questionnaires was normally low, but this has not been as great a disadvantage as would normally be expected. Mailed questionnaires were used for Fort Simpson, or when clients or operators in each settlement could not be reached for an interview. Alternate sources, usually information provided by the traffic directors of common carrier services in each settlement, were relied upon in the event of no direct response.

The choice of a suitable statistical time framework was complicated by the marked seasonal and annual variations which characterize some northern shipping patterns.[18] It was decided that statistics based on an operating year, June 1972 to June 1973 would provide the most reliable estimate of northern shipments.[19] Most northern operators and businessmen indicated that shipment data for this time period would provide a representative view of their operations over the past few years. The initial impact of renewed exploration and development activity on northern suppliers and services had passed by the end of the 1972 summer season, but business activity and overall demand have remained above levels of the late sixties. D. S. Robinson, traffic manager for Northern Transportation Company (NTCL) summarizes the industry's attitude.

> *The 1972 season -- we operate on the Mackenzie River from late May to early October -- was the biggest season in NTCL history, mainly due to unprecedented demands from the oil exploration industry. In 1973, the volume shipped has dropped to 330,000 tons compared to 396,000 tons in 1972. NTCL fleet capacity has been greatly improved this season with the addition of 20 new barges and 5 tugs. Barring any really major developments in the Mackenzie Valley (say, federal approval for a northern pipeline), we expect the demand for our service to remain slightly above the 1973 level for several seasons.*[20]

Similar statements were received from the traffic directors at Pacific Western Trucking,[21] Hay River Truck Lines,[22] and several other motor carrier operators. In general, motor carriers did not experience the same surge in demand during 1972 felt by NTCL, and many of the major air freight operations. Few trucking firms anticipate any dramatic increase in the volume of traffic handled during the next few years.

Interview and questionnaire data collected during the summer and fall of 1973 were compiled and tabulated by computer to simplify the use of mathematical analytic techniques, and the interpretation and presentation of information in the final thesis.

The Setting

The study area is best defined as the Mackenzie Valley Area, which " .. is a recognizable region within the Canadian North, defined in large part by its transportation orientation."[23] The physical, political, or economic boundaries which may be chosen to delimit the Mackenzie Valley Area do not correspond exactly in space. For the purposes of this study, it is necessary to define the Mackenzie Valley Area on the basis of several criteria. Basically, the Mackenzie Valley Area is considered to include all areas of the Mackenzie River drainage basin north of Highway 16 in Alberta, northeast of the Alaska Highway in British Columbia, and bordering Lake Athabasca in northwestern Saskatchewan (Figure 1).

Except along its southern margins, the Mackenzie Valley Area is characterized by sparse population (Figure 2), limited agricultural activity, and resource-based local economies. Political control of the area is divided between three provincial authorities (Alberta, Saskatche-

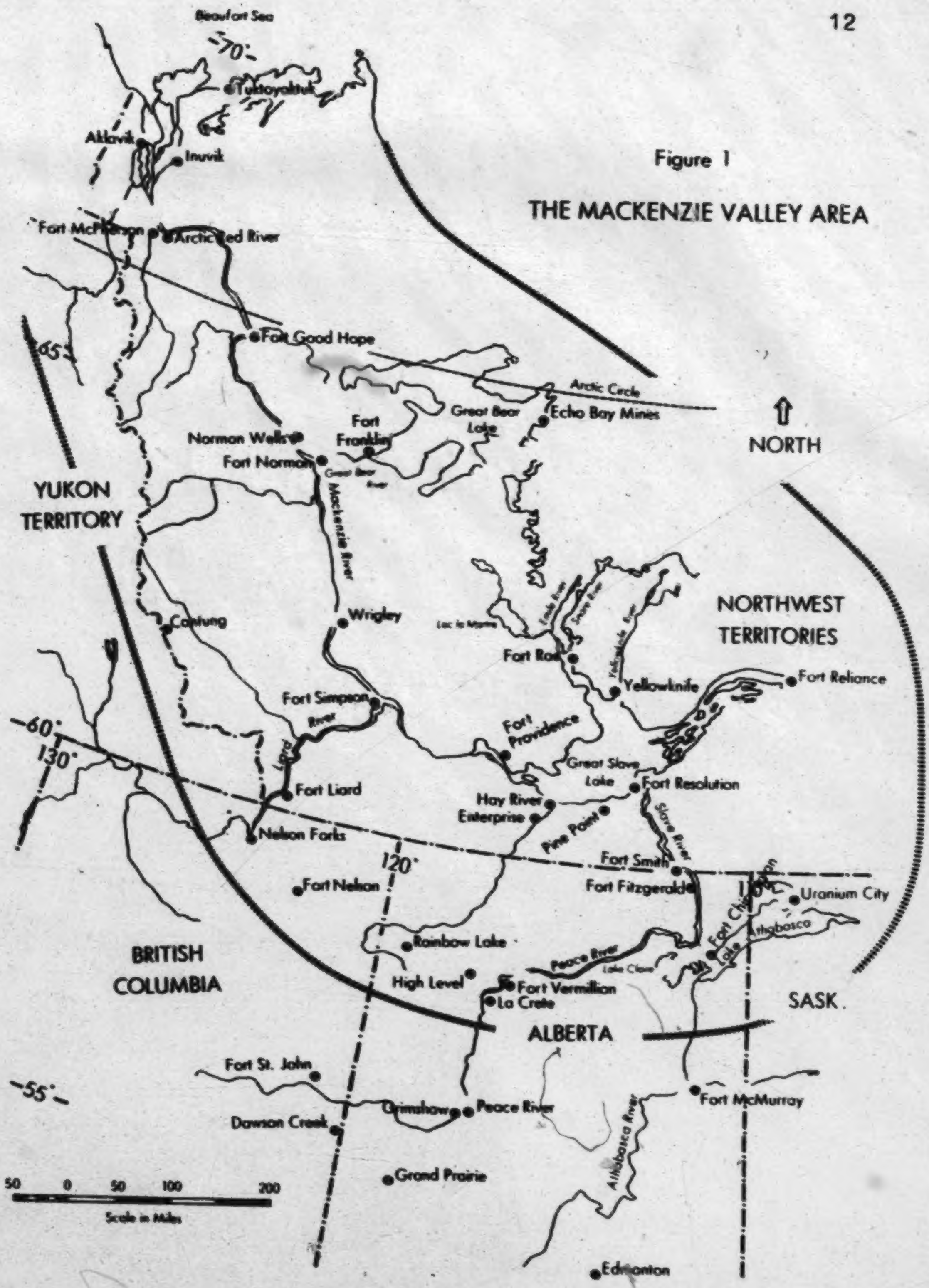


Figure 1

THE MACKENZIE VALLEY AREA

Beaufort Sea
70°
Tuktoyaktuk
Aklavik
Inuvik
Fort McPherson
Arctic Red River
Fort Good Hope
65°
Arctic Circle
Great Bear Lake
Echo Bay Mines
NORTH
Norman Wells
Fort Franklin
Fort Norman
Great Bear River
Mackenzie River
YUKON TERRITORY
Wrigley
Cantung
Lac la Martre
Fort Rae
Yellowknife
NORTHWEST TERRITORIES
Fort Reliance
Fort Simpson
Liard River
Fort Providence
60°
130°
Great Slave Lake
Fort Resolution
Fort Liard
Hay River
Enterprise
Pine Point
Slave River
Nelson Forks
120°
Fort Smith
Fort Fitzgerald
110°
Uranium City
Fort Nelson
Fort Chipewyan
Lake Athabasca
Rainbow Lake
Peace River
Lake Claire
BRITISH COLUMBIA
High Level
Fort Vermillion
La Crete
SASK.
ALBERTA
Fort St. John
55°
Fort McMurray
Grimshaw
Peace River
Dawson Creek
Athabasca River
Grand Prairie
50 0 50 100 200
Scale in Miles
Edmonton

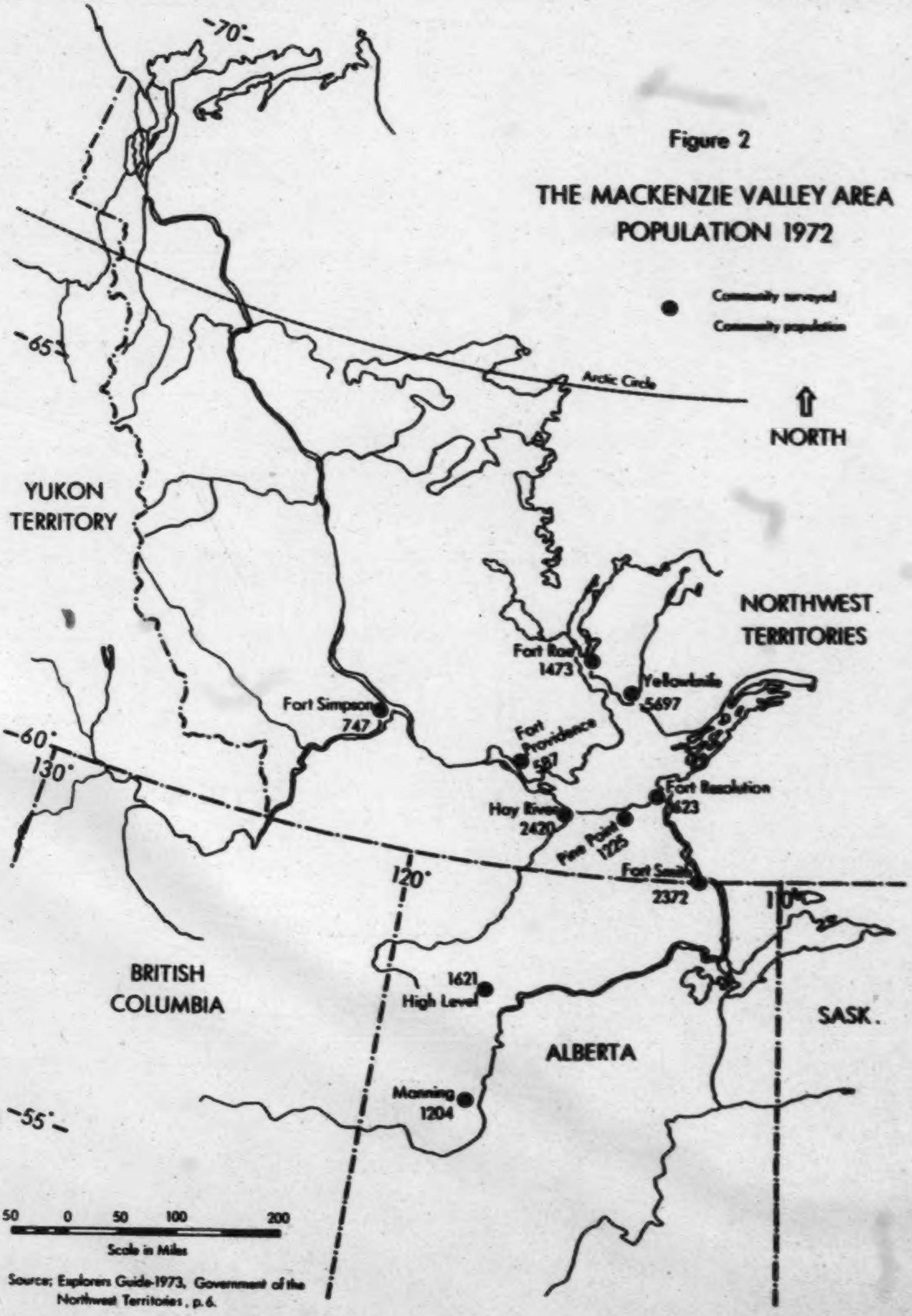


Figure 2

THE MACKENZIE VALLEY AREA POPULATION 1972

● Community surveyed
Community population
Arctic Circle
⇧ NORTH
70°
65°
60°
55°
130°
120°
110°
YUKON TERRITORY
NORTHWEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASK.
Fort Rae 1473
Yellowknife 5697
Fort Simpson 747
Fort Providence 587
Hay River 2420
Pine Point 1225
Fort Resolution 623
Fort Smith 2372
1621 High Level
Manning 1204
50 0 50 100 200
Scale in Miles

Source; Explorers Guide-1973, Government of the Northwest Territories, p.6.

wan, and British Columbia), and two territorial governments (Yukon and Northwest Territories). On a constitutional basis, the provincial governments, and to a more limited extent the Yukon Territorial Government, are not required to seek federal authorization to implement northern development plans. The Government of the Northwest Territories is relatively less autonomous, and depends on Ottawa for a major proportion of Territorial operating funds.

The influence of Ottawa, through several federal departments, on the development of transportation systems in northern Canada, is considerable. Federal authorities are especially concerned with the quality and efficiency of transportation facilities which exist in the Mackenzie Valley. Compared to other areas of the Canadian North[24] transport services in the Valley are well developed, but the degree of utilization and forseeable demand are also high.

Geography and history have reinforced the position of the Mackenzie waterway as the "backbone" of freight movements in the Mackenzie District and to the Western Arctic. Even to-day, when the rapid movement of goods by cargo aircraft, highway transport, and rail is becoming more competitive with river transport,[25] the initial importance of the marine system in the Mackenzie Valley is apparent.

Most branches of the Mackenzie Valley road system terminate at settlements originally supplied by barge,[26] and major air trans-shipment points in the Valley lie on navigable water routes. Future rail or highway facilities are also likely to parallel the Mackenzie River system (Figure 3).

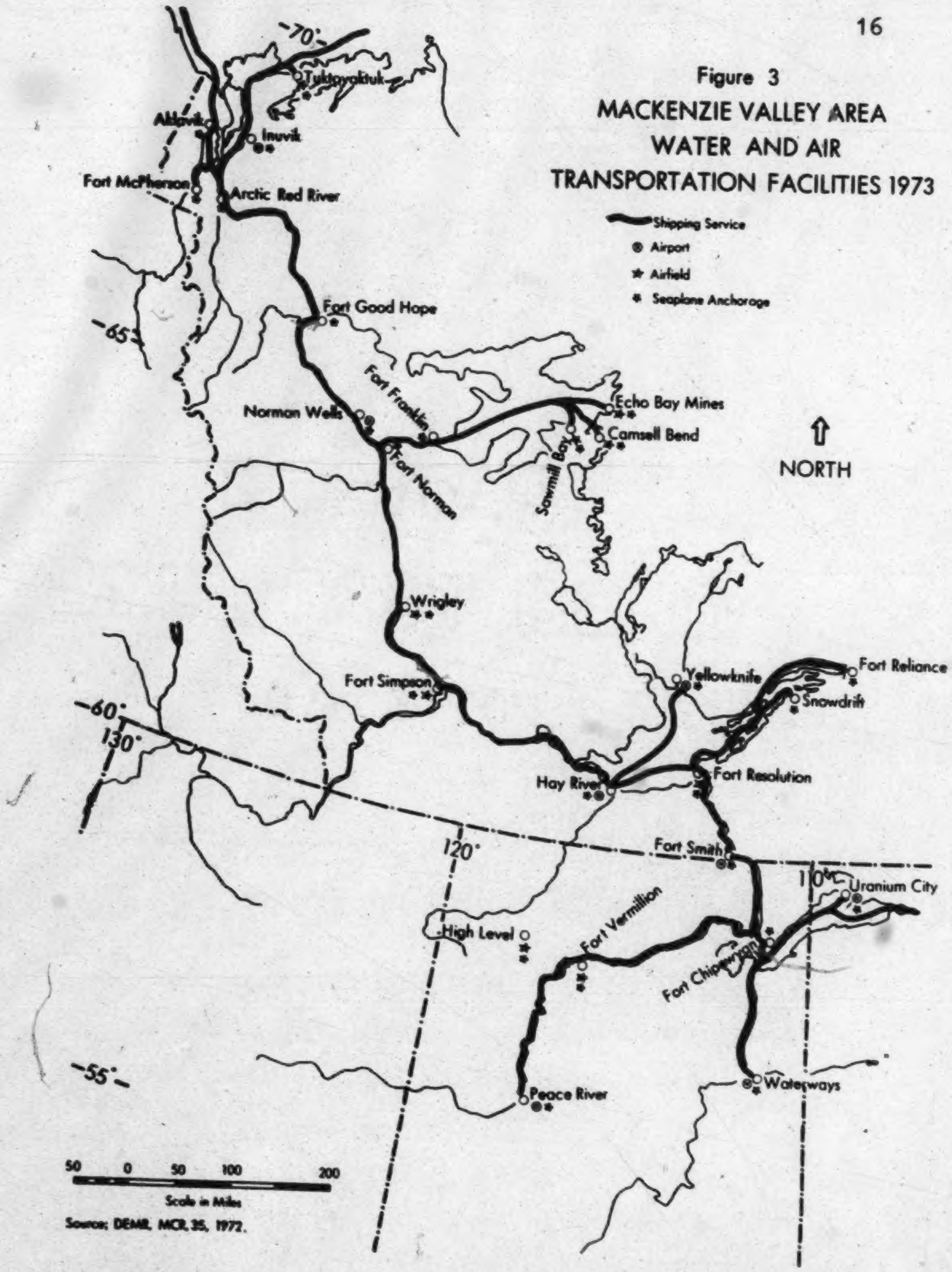
Physiography and economics have fortified the dominant influence of the marine route on the development of alternate land transport modes. Climatic patterns are relatively uniform throughout the Mackenzie Valley, and most of the region is classified as subarctic, except north and northeast of Great Bear Lake where it fringes into the Arctic zone. The region is characterized by:

> *... extreme length of the night in the winter and of the day in summer .... (and) ..... enormous range (of temperature) from winter to summer, notable even for Central Canada.*[27]

The entire area is characterized by extreme continentality, low annual precipitation and temperatures, and generally, stable conditions prevail. A consequence of the region's climatic character of greatest significance to the development of land transportation systems is the disposition of the region "... toward frozen ground and ....permafrost...." which "... is strongly

Figure 3

MACKENZIE VALLEY AREA
WATER AND AIR
TRANSPORTATION FACILITIES 1973


Shipping Service
Airport
Airfield
Seaplane Anchorage
NORTH
70°
65°
60°
55°
130°
120°
110°
Tuktoyaktuk
Aklavik
Inuvik
Fort McPherson
Arctic Red River
Fort Good Hope
Fort Franklin
Norman Wells
Fort Norman
Echo Bay Mines
Camsell Bend
Sawmill Bay
Wrigley
Fort Simpson
Yellowknife
Fort Reliance
Snowdrift
Fort Resolution
Hay River
Fort Smith
Uranium City
Fort Vermillion
High Level
Fort Chipewyan
Peace River
Waterways
50 0 50 100 200
Scale in Miles

Source: DEMR, MCR.35, 1972.

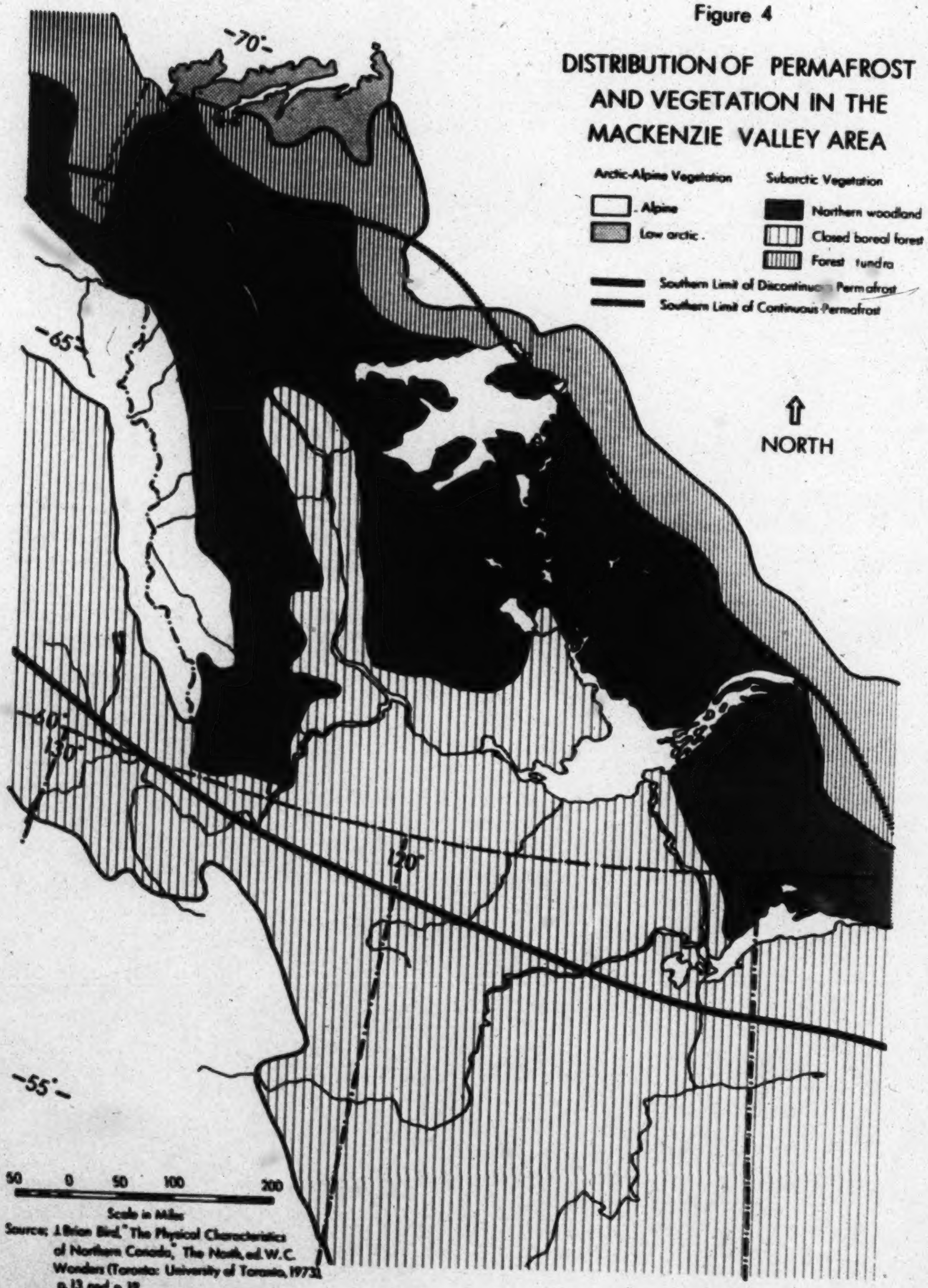
developed"[28] in all areas of the Mackenzie Valley (Figure 4).

Annual precipitation is low, but due to low annual temperatures, the short runoff season, and the presence of perennially frozen ground which restricts drainage, the Mackenzie Valley is a region of surplus water storage. In locales where permafrost conditions occur, and the surface soils contain a large proportion of water, difficulties faced in the design and location of land transportation modes can be significant, and may limit the feasibility of operation in particular areas.[29]

The physiography and bedrock geology of the Mackenzie Valley are closely associated and affect the distribution and extent of permafrost. Parts of three physiographic regions are represented in the Mackenzie Valley (Figure 5). East of a line which roughly cuts through Dease Arm on Great Bear Lake and the North Arm of Great Slave Lake, granitic rocks of the Precambrian Canadian Shield form an undulating and broken topography, inaccessible by conventional ground transport. Extensive deposits of well-developed organic soils are almost totally absent in the Shield region. Rock outcrops, sparse vegetation concentrated in hollows and depressions, and numerous shallow lakes form the most conspicuous elements in the landscape.

Figure 4

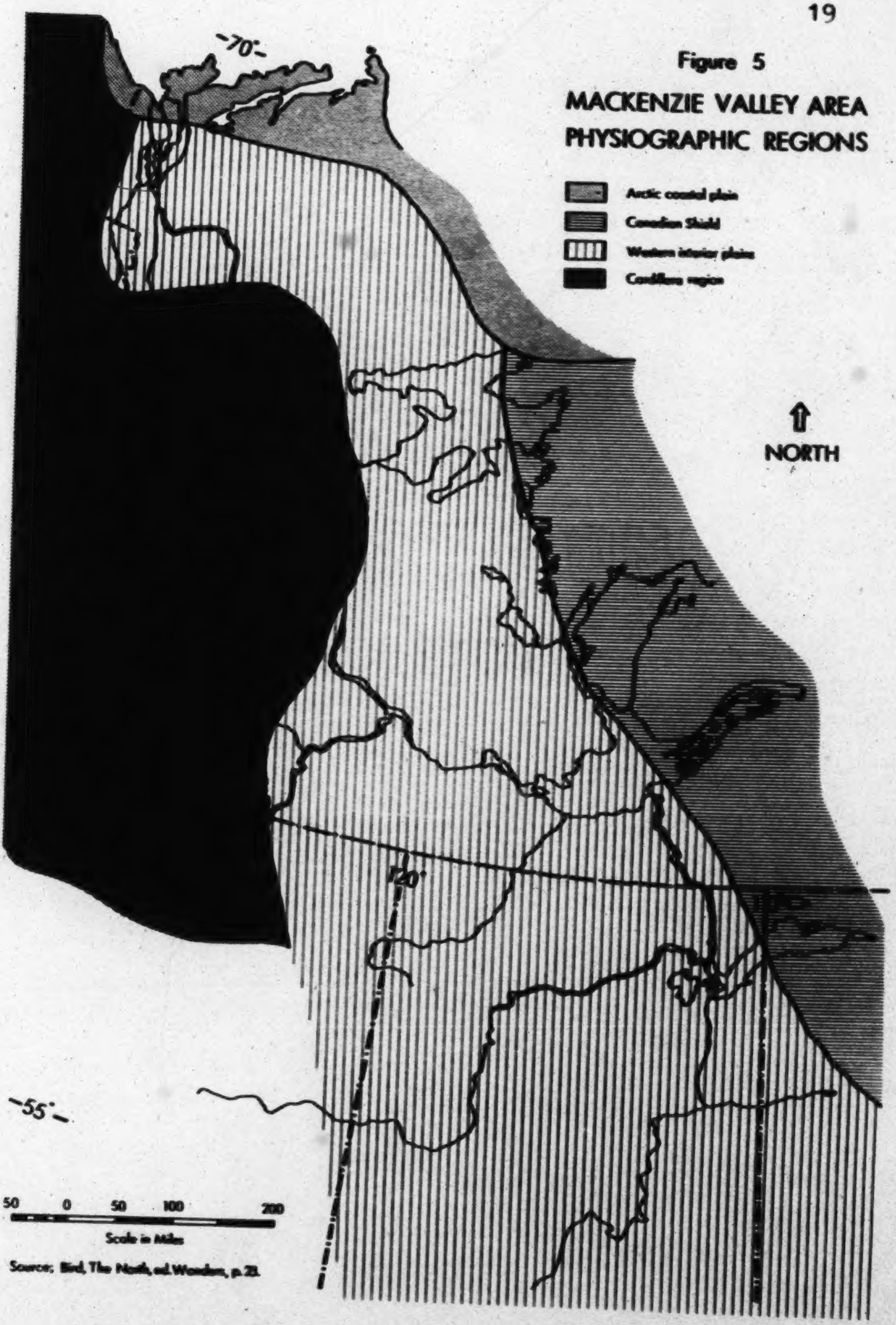
DISTRIBUTION OF PERMAFROST AND VEGETATION IN THE MACKENZIE VALLEY AREA


Arctic-Alpine Vegetation
Alpine
Low arctic
Subarctic Vegetation
Northern woodland
Closed boreal forest
Forest tundra
Southern Limit of Discontinuous Permafrost
Southern Limit of Continuous Permafrost
NORTH
70°
65°
60°
130°
120°
55°
50 0 50 100 200
Scale in Miles

Source; J. Brian Bird, "The Physical Characteristics of Northern Canada," The North, ed. W.C. Wonders (Toronto: University of Toronto, 1973), p. 13 and p. 19.

Figure 5

MACKENZIE VALLEY AREA
PHYSIOGRAPHIC REGIONS


-70°-
Arctic coastal plain
Canadian Shield
Western interior plains
Cordillera region
NORTH
120°
-55°-
50 0 50 100 200
Scale in Miles

Source: Bird, The North, ed. Wonders, p. 23.

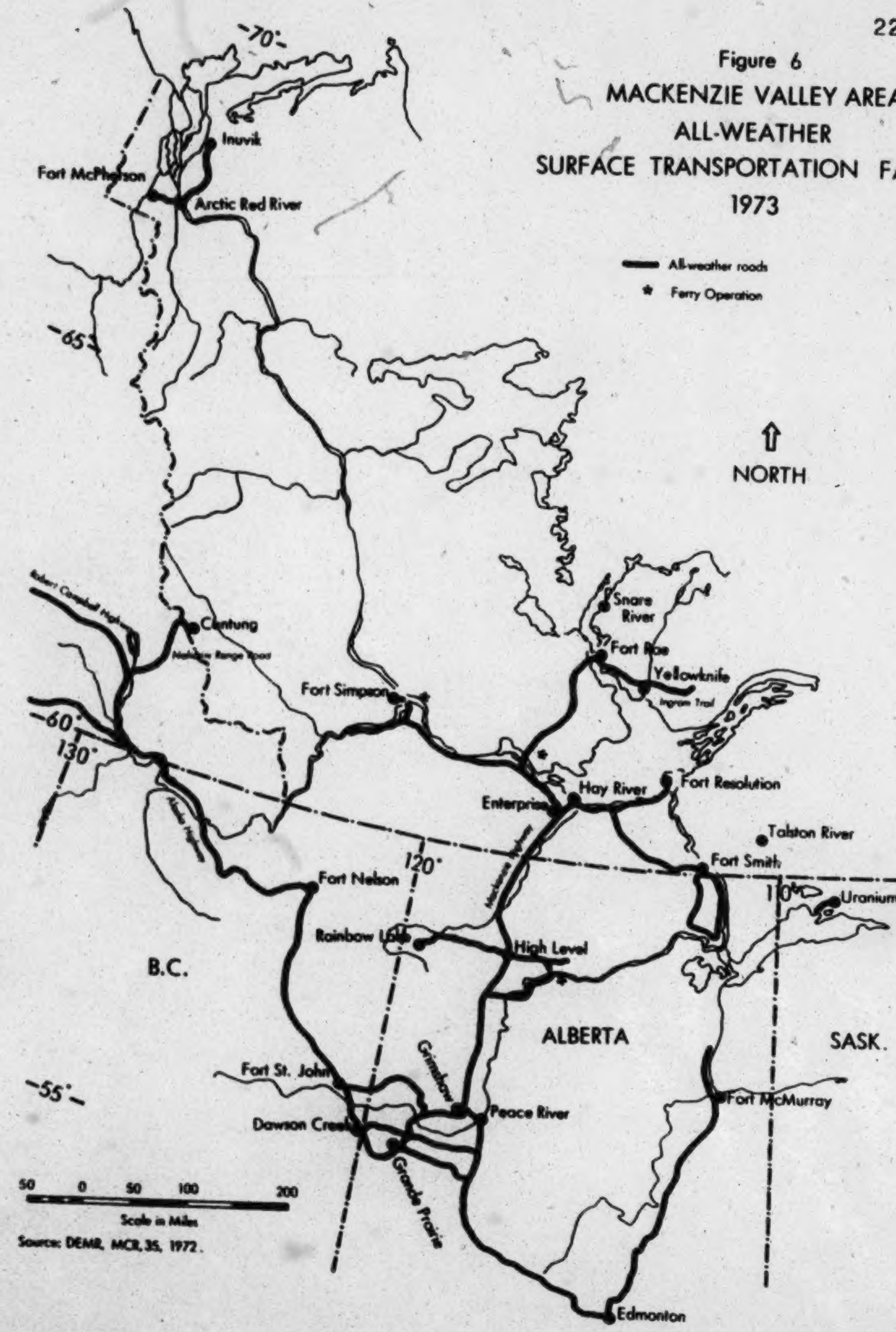
West of the northwest-southeast trending line, which marks the contact zone between the Precambrian Shield and Cretaceous sedimentary deposits of the Mackenzie Valley, soils are moderately well developed, and the region as a whole is heavily vegetated. In the sedimentary basin, discontinuous permafrost conditions in high-ice content, fine-grained soils are common, and impose limitations on the design, construction, and operation of land facilities.[30] Construction plans for completion of the Mackenzie Highway to Inuvik have been held up by environmentalists and engineers. Every effort is being made to rapidly develop methods to ensure the integrity of the highway in zones of continuous and discontinuous permafrost along the right-of-way.[31] However, the availability of large quantities of suitable road-building material, the absence of steep grades, and the initial pattern of settlement determined by water transport in the plains region, outweigh the disadvantages of construction in permafrost and the expense of road construction in the Precambrian.

Western extension of the transportation network in the Valley is limited by the mountain barrier of the Cordillera along the western margin of the Mackenzie Valley Area. The present pattern of a system of transport concentrated on a north-south axis in the sedimentary regions of the Valley, and complimented by secondary lateral arteries to isolated resource centres and settlements (Figure 6) will likely persist for many years in the Canadian North.

Whenever practical in the following chapters, the influence of northern climate or physical factors on the operation and development of northern surface transportation facilities is considered. In Chapter Two, the literature and sources of information utilized in compiling this thesis are discussed. Chapter Three provides a brief history of the development of the northern road system and the northern motor carrier industry. Chapters Two and Three are intended to provide a foundation for the analysis of motor carrier operations in the Mackenzie Valley contained in Chapters Four and Five. The last three chapters are less empirical and are intended to present as accurate an interpretation of the present trends as is possible, to predict the future patterns of development in the northern motor carrier industry, and to present the major conclusions derived from the study.

Figure 6

MACKENZIE VALLEY AREA ALL-WEATHER SURFACE TRANSPORTATION FACILITIES 1973


All-weather roads
Ferry Operation
NORTH
70°
65°
60°
55°
130°
120°
110°
Inuvik
Fort McPherson
Arctic Red River
Snare River
Fort Rae
Yellowknife
Ingraham Trail
Cantung
Robert Campbell Hwy
Nahanni Range Road
Fort Simpson
Enterprise
Hay River
Fort Resolution
Talston River
Fort Smith
Uranium City
Alaska Highway
Mackenzie Highway
Fort Nelson
Rainbow Lake
High Level
B.C.
ALBERTA
SASK.
Grimshaw
Fort St. John
Peace River
Dawson Creek
Grande Prairie
Fort McMurray
Edmonton
50 0 50 100 200
Scale in Miles

Source: DEMR, MCR.35, 1972.

CHAPTER 1

FOOTNOTES

[1] J. L. Jenness, "Federal Roads Program in Northwestern Canada," in Proceedings, British Columbia Natural Resources Conference, Harrison, 1959, p. 108.

[2] Canada, Department of Indian Affairs and Northern Development (DIAND), Canada's North 1970-1980 (Ottawa: Information Canada, 1972), p. 14.

[3] Ibid., pp. 7-9.

[4] Jean Chretien, "Plain Talk on Northern Development," Communique (Ottawa: DIAND, 12 June 1972), p. 2.

[5] Marine and air transportation services in the North are amongst the most sophisticated in Canada. Modern and efficient land transportation services have evolved more slowly, and are still below southern standards.

[6] The Mackenzie Valley Area is described and delimited on pp. 11-14.

[7] The Province Vancouver, 5 July 1972, p. 72.

[8] G. Rempel, "Northern Transportation," Arctic Summer School Field Notes (Edmonton: Boreal Institute of Alberta, 1973), p. 187.

[9] For example, Pacific Western Trucking, one of the principal common carriers operating in the Mackenzie Valley was not approached in a recent study conducted for the Department of National Defence.

[10] See: Jean Chretien, "Plain Talk on Northern Development," Communique (Ottawa: DIAND, 12 June 1972), pp. 1-5, and also; Policy Statements (Edmonton: Northern Development Committee, Edmonton Chamber of Commerce, 1970-72).

[11] Considering "transportation" in its broadest interpretation, the transmission of information is fast becoming an important component of "total transportation service." (e.g., the Canadian National-Canadian Pacific system offers "total transportation services" which includes data systems and tele-communications.

[12] K. J. Kansky, Structure of Transportation Networks (Chicago, University of Chicago, 1963).

[13] Pers. interview, John Attrell, Service Representative for the Alberta Motor Transport Association, June 1973.

[14] Under the Northern Roads Program, every major mining property of proven potential will eventually be within 200 miles of an all-weather highway (Pers. corresp., A. T. Jordan, Northern Program Planning Division, DIAND, Ottawa, 20 August 1973).

[15] That is, between air, marine, and surface carriers.

[16] With the exception of Fort Simpson, which was surveyed by mail due to poor road conditions between Kakisa Junction and Fort Simpson in July 1973.

[17] The road was completed to Fort Simpson early in 1970 and the Hay River - Fort Simpson section opened in 1966. Hay River and Yellowknife have been served by all-weather road since 1948 and 1959 respectively.

[18] In particular, marine transport but winter road trucking operations are also limited by climatic conditions.

[19] After this referred to as the "1972 operating season."

[20] Pers. communication, D. S. Robinson, Traffic Manager, Northern Transportation Company Limited, Edmonton, 12 September 1973.

[21] Pers. interview, R. S. Small, Traffic Director, Pacific Western Trucking Division Limited, Edmonton, 12 September 1973.

[22] Pers. interview, P. Graham, General Manager, Hay River Truck Lines Limited, Edmonton, 11 October 1973.

[23] W. C. Wonders, "Roads and Winter Roads in the Mackenzie Valley Area," in Occasional Papers, B. C. Division, Canadian Association of Geographers (Vancouver, 1962), no. 3, p. 1.

[24] Referring to all areas north of the sixtieth parallel and administered by the Government of Canada.

[25] Warnock-Hersey International Ltd., Arctic Transportation Study (Ottawa: Information Canada, 1970), passism.

[26] G. W. Rowley, "Settlement and Transportation in the Canadian North," Arctic, vol. 7, no. 3-4, 1954, pp. 336-342.

[27] B. W. Currie, and W. G. Kendrew, The Climate of Central Canada (Ottawa: Queen's Printer, 1955), pp. 73-76.

[28] J. Brian Bird, The Physiography of Arctic Canada (Baltimore: John Hopkins Press, 1967), p. 21.

[29] See J. Ross Mackay, "The World of Underground Ice," AAAG, vol. 62, no. 1 (March) 1962, pp. 1-5, and also; "Permafrost," Paper no. 63, Technical Education Committee, Canadian Gas Association, 1971.

[30] R. J. Brown, Permafrost in Canada (Toronto: University of Toronto, 1970), pp. 185-186.

[31] Edmonton Journal, 12 March 1973, p. 5.

CHAPTER 2

SURVEY OF LITERATURE AND INFORMATION SOURCES

> *Research on an expanded scale is a continued prerequisite if governments, industry, and all others concerned in the development and protection of the northern environment are to have timely and sufficient data on which to base their plans, decisions, methods, and activities.*[1]

General Sources

Few reliable works exist on the early history of truck transportation in the Mackenzie Valley. John McKay, purchasing agent for Giant Yellowknife Mines, provided the first basic account in 1960.[2] McKay's article details the early developments leading to all-weather and winter road trucking operations on the north shore of Great Slave Lake, and includes some interesting information about the first men, such as John Dennison[3] and Al Hamilton[4] who pioneered northern trucking. McKay also discusses the effect of highway transportation on mine inventories and prices in Yellowknife.

R. J. Rea provides more detailed information about the political and economic considerations behind the extension of the northern highway system. Rea points out that:

> *... the provision of such facilities was limited in most cases to undertakings which promised to be self-liquidating ... or justifiable on the basis of an established need.*[5]

Rea emphasizes that until very recently northern transportation expenditures were based on a determination of the benefits which might be expected to accrue to the "... country as a whole,"[6] and not just to the northern territories. He critically examines the "Roads to Resources" programme and includes many references of historical interest.

In his paper, William Wonders discusses the geographic significance of road developments in the Mackenzie Valley, and considers the economic benefits of winter road versus all-weather road facilities in areas of mineral development and uncertain future demand. Wonders remarks that "... northern development is costly," and "... hinges mainly around transportation improvements."[7] He concludes that northern "economic" development must be the result of careful planning:

> *... on a coordinated basis so as to avoid unnecessary costs and for the maximum benefit of the country at large. In such planning, geographers have both an opportunity and an obligation to make a significant contribution.*[8]

Zapf has provided one of the earliest articles available which considers the problems imposed on highway design by the northern environment. Zapf is concerned with the factors which justify highway construction in remote, unsettled regions, and the compromises which are necessary to ensure adequate highway facilities at least cost in the North. Zapf warns "... while the aim will be to keep costs to a minimum, the cheapest road will not necessarily be the best solution"[9] especially when you consider the peculiar circumstances which face northern highway engineers. He suggests that the:

> *... location, design and construction of a northern road .... poses problems entirely different from those normally encountered to provide facilities in more civilized areas.*[10]

The federal government role in northern road development is discussed in an early article by J. L. Jenness.[11] In 1959, Jenness told the Twelfth British Columbia Natural Resources Conference at Harrison Hot Springs:

> *... there are a number of areas in the world where transportation -- by any means -- is so sorely inadequate that development has failed to take place, or at least has not kept pace. One of these areas is Northern Canada.*[12]

Jenness explains the initial aims of the "Roads-to-Resources" and "territorial Roads" development programs, and he emphasizes that geographic factors, especially distance and inaccessibility, have retarded the rate of northern road extension and integration with existing networks in southern Canada. The address ends with the reservation:

> *The federal government realizes that its improvements to transportation and its other far northern programs can never fully eliminate from Arctic Canada the fundamental geographic disabilities of distance and climate.*[13]

Several other early articles which discuss northern road transportation are worthy of mention. Among the most informative are those by Hemstock,[14] Main,[15] Herbert,[16] and Weick.[17] Hemstock is the Northern Operations Manager for Imperial Oil and is well-informed about developments in the Mackenzie Valley.[18] In his article, he considers the relative importance of barge transportation to northern operations. In later papers,[19] Hemstock assesses the significance of road development to Imperial's activity north of the sixtieth parallel, and the important effects of northern activity on people and the environment.

"Transportation as a Factor in Northern Development,"[20] by J. R. K. Main, is considerably out-of-date and his discussions of various transportation modes, relative merits, and feasibility rest on a tenuous base at times. However, the article does provide a good summary of the facilities in existence in 1961, and an excellent discussion of the advantages and disadvantages of rail transport systems compared to highways as catalysts to development in the Canadian North. Herbert's work contains an excellent historical summary, and emphasizes the resource-base of northern road and water transportation operations. Weick, who is with the Economic Development Branch in Ottawa, has published several papers -- which are available through the Department of Indian Affairs and Northern Development (DIAND) -- on northern transportation. Several of his earliest works, presented as addresses to the Canadian Transportation Research Forum, are empirically based and concern the federal government role in the development of northern transport facilities. Weick is especially interested in the comparative advantages of alternate transport modes in the North.[21]

More recent works of interest to northern transportation students include several collections of papers prepared for northern conferences. The Proceedings of the Arctic Transportation Conference - 1970, contain addresses by Woodward,[22] Fuller,[23] Cornblat,[24] Haefele,[25] and Wyman,[26] which are informative. Woodward discusses the Northern Road Program and outlines the basic guidelines of the Territorial Road Policy. The graphs and tables which follow Woodward's article are an excellent source of empirical data. Fuller presents an academic plea to maintain a constant vigilance over all northern projects capable of affecting the northern environment. His criticisms of the Northern Road Program contrast sharply with Woodward's optimism. Fuller concludes;

> *A doctoral dissertation could be written on the human ecology of northern roads, but perhaps I have said enough to indicate that I think there are many ways in which the Northern Roads Program could be improved.*[27]

Transportation facility costs and charges are discussed by Cornblat and Wyman. Haefele considers the feasibility of user-charges for northern transportation facilities, and emphasizes the gulf which exists between northern transportation development costs and the revenues generated by northern transport services. The question of user-charges is a valid one in the northern situation, and an understanding of the rationale behind user-charges is essential to a discussion of northern motor carrier operating economies.

The papers of the National Northern Development Conference held in Edmonton every three years since 1958, are an excellent collection of information on every aspect of northern development. An extensive list of registrants attending each conference is included with each collection of conference papers and is useful for obtaining original, up-to-date references and comments. Representatives from the transportation industry have actively participated in the conferences. Arctic and Middle North Transportation, edited by Beverly Sater, like the Northern Development Conference papers, is a short collection of keynote addresses, and is valuable as a source of personalities associated with various northern transportation operations and development interests.

Several other articles and publications are relevant to this study, and should be mentioned. Engineering studies prepared by Associated Engineering Services for the federal Department of Public Works provide a good background to the engineering requirements for northern highways, and discuss specific proposals for future road developments in the North. Other studies, such as the 1970 Arctic Transportation Study conducted by Warnock-Hersey International, and the Economic Study of Transportation in the Mackenzie River Valley by Travacon Research, consider the efficiency and operating costs of various northern transportation systems.

The Warnock-Hersey report is based on the assumption that oil and gas pipelines will be constructed in the Mackenzie Valley before 1980, and that major expansions in all existing modes of transport will be necessary to meet the increase in demand for services which will result from pipeline construction activity. Travacon's study -- which has not been released to the general public -- is a more general consideration of existing and future transportation requirements in the Mackenzie Valley. Greater emphasis is given to the role of land transportation and the influence of mineral exploration and exploitation on transportation developments, than in the Warnock-Hersey analysis. The Improvement Program for The Alaska Highway contains some basic information on truck transportation in northern British Columbia and the Yukon. Methods of data collection and analysis used by the Stanford Research Institute in the preparation of the program were useful as guidelines in this study.

The section on transportation in Brown's Permafrost in Canada, includes a concise discussion of the effect of permafrost on road construction and maintenance. The chapter contains many good examples of the limitations imposed by the northern environment on transport. Brown concludes:

> *Permafrost can cause problems in all stages of construction ... Roads....differ from other engineering structures (except power transmission lines) because they extend over hundreds of miles and it is possible for permafrost conditions to change along the route ... necessitating variations in construction*

> *and maintenance technique.*[28]

The importance of transportation to northern development is emphasized and, while Brown recognizes the considerable disadvantage to rapid economic expansion permafrost represents, he adopts a refreshing spirit of optimism. As the foremost Canadian authority on construction in permafrost, his basis for belief in the Canadian North is persuasive.

> *Permafrost is not the only factor affecting northern development nor is it the only one discouraging it. Northern development will proceed in any event, but permafrost will continue to exert a definite influence and the economics of the situation will have to be considered.*[29]

Michael Marsden's treatment in The North, is one of the most authoritative, concise discussions of northern transportation available. While the "... physical problems are serious"[30] in the North, Marsden is confident that the fundamental obstacles to northern transportation improvements "... are economic, and usually they are common to any frontier area."[31]

Few technical or academic considerations of the northern motor transport industry have been published. As a result, considerable reliance on more general references, usually American, which discuss the development and operations of southern motor-carrier systems has been necessary. It has usually been possible to integrate information obtained from interviews and correspondence with information available in the literature to provide an accurate perspective of peculiarities and similarities of northern service compared to the better-documented southern systems.

In Transport Competition and Public Policy in Canada, H. L. Purdy investigates nearly every facet of the Canadian motor transport business, and provides the first accurate assessment of the regional motor-carrier's role in the Canadian transport industry. Many of his comments are relevant to northern situations. For example, Purdy concludes that competition created by motor carrier services has helped to:

> *... widen the horizon of choice within which individual businesses and industries may operate in planning production and supplying markets within Canada and abroad.*[32]

It might be noted here that, in the Mackenzie Valley, where the absence of backhaul traffic may double transport costs (and charges) for all carriers, truck transport has the advantage of being "footloose." That is, truckers may dispatch their units considerable distances to obtain southbound traffic and still maintain an adequate margin of profit.

Purdy believes that, as the road network expands to service mineral and other resource-based developments in remote regions, competition for the backhaul traffic generated at mine sites or lumber mills will increase, and help offset the high costs of northern shipments. Motor carrier regulations, trends in the Canadian industry, the effect of road-loading limits on regional truck traffic, the nature of commodities carried, linehaul expenses, quality of service, and equipment, are just a few examples of subjects discussed in Purdy's text. Comparisons with northern circumstances are usually possible, and frequently enlightening.

Another work, Commercial Motor Transportation, by Charles A. Taff, is designed as a handbook for motor-carrier operations, and explains each aspect of the trucking industry in considerable detail. His discussions of operating costs, rate scales, and inter-modal competition are very useful. Taff considers the economies of "piggyback,"[33] container, and multiple trailer combinations. These, and other specialized trucking services have received a great deal of attention in the North during the last decade.

Helvig's study of Chicago's External Truck Movements is of more limited value to a study of northern trucking operations. But, Helvig does include a theoretical discussion of the significance of transportation research, and he reviews several classic transportation studies. Transportation studies are important because;

> *transportation, as the agent performing the movement and spatial interaction, to-day must be considered one of the key factors in the functioning of society.*[34]

Helvig concludes, on the basis of his study, that transportation flows follow general laws of interaction, and that it is possible to construct predictive models which allow us to forecast future flows reasonably accurately. Until the location and value of northern resources are more confidently mapped, it is hard to imagine that predictive models may be developed to assess future demands "reasonably accurately." However, given reliable information, it does seem practical, as Helvig suggests:

> *.... to construct a model which basically describes the movement for truck transportation, which accounts for areal variations in motor carrier traffic generation and movements.*[35]

There are many parallels between inter-urban truck transportation and northern trucking. Certain sectors of the urban economy generate greater demands for truck transport. For example, Helvig demonstrates that "... commercial land has by far the greatest attractive power. ... and public services and buildings generate the least."[36] We should attempt to determine the transportation demand generated by various sectors of the northern economy and test the applicability of Helvig's hypothesis that:

> *Land use is the key to understanding transport generation and attraction, and the destination pattern in the area.*[37]

Theoretical and methodological studies by Isard, Kansky, Kissling, Taaffe, and others provide the basic guidelines for transportation research, regardless of the mode studied. Isard considers transportation to be a "vital aspect of production -- as vital, perhaps, as the functions of labour, land, resources, and the entrepreneur,"[38] and he has suggested many useful techniques for regional transportation analysis. Network description and measurement techniques developed by Kansky and Kissling were useful for the consideration of circuitous routes in the Mackenzie Valley, presented in Chapter Seven. The discussion of "Transportation and Spatial Processes," in Geography of Transportation, by Taaffe and Gauthier, facilitated the analysis and presentation of data on line-haul operating costs and northern traffic movement. Several other techniques examined by

Taaffe and Gauthier suggested productive channels of research.

Recent comments by Leggett and Hardy, contained in Science and the North, are enlightening and include valuable suggestions for the future direction of northern research. Leggett calls for a coordinated effort from researchers to centralize "... for active use, the vast amount of information now available on northern technology."[39]

Government Publications

Leggett's comment is particularly appropriate to a discussion of information and statistical data on northern motor-carrier transport available from government agencies in Canada. What little data that is readily obtainable is poorly catalogued, generally out-of-date, and frequently very unreliable. All levels of government approached in this study admitted that their knowledge of motor-carrier operations in northern Canada, especially the Mackenzie Valley, was totally inadequate.

Mr. S. Mozes, Head of the Motor Carrier Statistics Division of Statistics Canada was able to supply basic information on operating incomes and revenues for common and contract carriers in Canada. As well, Mr. Mozes compiled some preliminary information on motor vehicle registrations in 1972, and origin-destination studies for intra-Alberta shipments in 1971 which were helpful.

Mr. W. Zayachkowski, Departmental Statistician with the Department of Indian and Northern Affairs provided a copy of the Executive Summary of a confidential report entitled Economic Study of Transportation in the Mackenzie River Valley. While the report is designed as a forecast of transport demands in the Mackenzie Valley during the next decade, some of the statistical information included served as a check on data compiled from questionnaires and interviews.

The Northern Canada Transportation Study, prepared for the Department of National Defence in 1970, contains a detailed summary of shipment volumes by mode from point-to-point in northern Canada. Some of the data is useful, but an effort must be made to check the motor-carrier statistics provided. Several inconsistencies and omissions were discovered in the course of this research.

Canada North of 60°, a monthly publication of the Department of Indian Affairs and Northern Development, contained many articles pertaining to developments in the Territorial Roads Program and Mackenzie Valley Highway issues. The publication emphasizes federal policies and attitudes towards northern development. Communique, also issued by DIAND, presents public addresses made by the Honourable Jean Chretien. Chretien's addresses are informative and in the past two years have centred around transportation problems in the North, particularly the economic and social impact of the Mackenzie Highway and pipelines on native northerners. Chretien is very concerned about "... the 'Toronto-Montreal Professional Northerners'...."[40] who believe it is "... fashionable .... to call for a freeze on northern development for two, three, or five years while southerners think out what they believe could be a better northern future."[41]

Population statistics for communities in the Northwest Territories and northern Alberta were obtained from the 1973 Explorer's Guide and the Canada Census 1972, respectively. J. R. Bentley, Department of Public Works in Yellowknife, and A. T. Jordan, in the Northern Program Planning Division of DIAND, supplied valuable information on the Fort Providence river crossing, the "Northern Roads Program," and the winter toll-road operated since 1964 by Bain Brothers Construction and PanCana Industries Limited in the Mackenzie Valley.

Copies of the Northwest Territories Vehicle Ordinance and a list of operating authorities in the territories were obtained from Frank Murphy, of the Territorial

Transport Board. The Transport Research and Development Branch, of the Alberta Department of Industry and Commerce provided data on provincial-territorial rate structures and operating regulations.

Other Information and Data Sources

Considerable reliance has been made upon daily newspapers, weekly business reports, and other resources of the public news media, for this study. It is impossible to list the dozens of articles and clippings used for much of the information, and it was found impractical to include all such references in the final bibliography. However, a few popular sources warrant specification. The Financial Post is an invaluable guide to trends in Canadian industry and economic development. Feature articles on northern issues often appear in the weekly publication. A special supplement to the Edmonton Journal, "Transportation -- North Western Canada's Key to Development,"[42] contained several articles on northern transport and current development in the motor-carrier industry.

Several papers distributed by the Canadian Transportation Commission, and other federal agencies provided an excellent foundation for the several theoretical digressions and considerations of the thesis (especially Chapters Six and Seven). Some of the most important papers in this category include Manders,[43] Wise,[44] MacPherson,[45] Haritos,[46] Shaw,[47] and Courtney.[48] The concise comparison of truck operating costs in northern Canada to operating expenses on gravel roads in southern Canada, by Mauzeroll,[49] provides up-to-date background information on trucking costs in all areas of northern Canada. Mauzeroll's report served as a comparative-base for motor-carrier operating expenses in the Mackenzie Valley, tabulated in Chapter Four.

It would be impossible to list all of the individuals who have provided basic traffic data used in this thesis. Some information has been obtained from the annual reports of major clients or carriers operating in the Mackenzie Valley. In many cases, no information could be obtained, due to the problems of highly competitive situations, and the usual difficulties which confront the researcher who deals with the public.

CHAPTER 2

FOOTNOTES

[1] Canada, Department of Indian Affairs and Northern Development, Canada's North 1970-1980 (Ottawa, 1972), p. 14.

[2] J. W. McKay, "Truck Transportation to Yellowknife - The Economic Effect on Inventories," unpublished manuscript courtesy of J. W. McKay, Purchasing Manager, Giant Yellowknife Mines Ltd., Yellowknife, 1961.

[3] J. B. Dennison managed the Pacific Western winter road to Echo Bay Mines until 1971. He is now semi-retired, and lives in Rutland, British Columbia.

[4] Al Hamilton and his brother Frank owned and operated Grimshaw Trucking and Distribution Limited, from 1954 to 1973. Grimshaw was purchased by the Northern Transportation Company (a Crown Corporation) in August, 1973.

[5] R. J. Rea, The Political Economy of the Canadian North (University of Toronto, 1969), p. 268.

[6] Rea, Ibid.

[7] W. C. Wonders, "Roads and Winter Roads in the Mackenzie Valley Area," in Occasional Papers, B. C. Division, Canadian Association of Geographers (Vancouver, 1962), no. 3, p. 17.

[8] Wonders, Ibid.

[9] N. R. Zapf, "Highway Location and Construction in the North," in Proceedings, British Columbia Natural Resources Conference, Harrison, 1959, p. 124.

[10] Zapf, Ibid., p. 123.

[11] J. L. Jenness, "Federal Roads Program in Northwestern Canada," in Proceedings, British Columbia Natural Resources Conference, Harrison, 1959, p. 108.

[12] Jenness, *Ibid.*, p. 109.

[13] Jenness, *Ibid.*, p. 114.

[14] R. A. Hemstock, "Transportation in the Canadian North," *Geology of the Arctic*, 1960, vol. 2, pp. 1135-40.

[15] J. R. K. Main, "Transportation as a Factor in Northern Development," in *Background Papers*, Resources for Tomorrow Conference (Ottawa: Queen's Printer, 1961), pp. 579-96.

[16] C. H. Herbert, "Development of Transportation in the Canadian North," *Canadian Geographical Journal*, November 1956, pp. 188-97.

[17] E. R. Weick, "Road Transportation in the Pioneer North" (an address presented to the Canadian Transportation Forum, Quebec City, 1965).

[18] Hemstock, "Transportation in the Canadian North," *Geology of the Arctic*, 1960.

[19] R. A. Hemstock, "Transportation, People and the Environment," in *Proceedings*, Arctic Transportation Conference, Yellowknife, 1970 (Ottawa: Information Canada, 1970), vol. 3, sec. 1, pp. 13-18.

[20] Also in; *Canada's Changing North*, ed. William C. Wonders, Carleton Library, 1971, no. 55, pp. 235-256.

[21] E. R. Weick and C. Merrill, A look at the future," *North*, vol. XVL, no. 3 (May-June 1969), pp. 57-67.

[22] H. W. Woodward, "Northern Road Program," in *Proceedings*, Arctic Transportation Conference, vol. 2, sec. 3, 1970, pp. 151-180.

[23] W. A. Fuller, "Transportation and the Ecology," in *Proceedings*, Arctic Transportation Conference, vol. 3, sec. 1, 1970. pp. 37-46.

[24] J. C. Cornblat, "Transportation Facility Costs and Charges," in *Proceedings*, Arctic Transportation Conference, vol. 3, sec. 2, 1970, pp. 49-86.

[25] E. T. Haefele, "The Feasibility of User Charges in Northern Transportation," in *Proceedings*, Arctic Transportation Conference, vol. 3, sec. 2, 1970, pp. 87-96.

[26] K. Wyman, "Transportation Facility Costs and User Charges," in *Proceedings*, Arctic Transportation Conference, vol. 3, sec. 2, 1970, pp. 97-110.

[27] Fuller, "Transportation and the Ecology," in *Proceedings*, Arctic Transportation Conference, vol. 3, sec. 1, 1970, p. 38.

[28] R. J. E. Brown, *Permafrost in Canada* (University of Toronto, 1970), p. 107.

[29] *Ibid.*, p. 138.

[30] Michael Marsden, "Transportation," *The North*, ed. William C. Wonders (University of Toronto, 1972), C. 3, p. 41.

[31] *Ibid.*

[32] H. L. Purdy, Transport Competition and Public Policy in Canada (Vancouver: University of British Columbia, 1972), p. 57.

[33] Also known in the industry as "TOFC" or trailer-on-flatcar. Purdy also discusses the importance of "piggyback" services in Western Canadian freight movements.

[34] Magne Helvig, Chicago's External Truck Movements (Chicago, University of Chicago, 1964), p. 1.

[35] Helvig, Ibid., p. 8.

[36] Helvig, Ibid., p. 39.

[37] Helvig, Loc. cit.

[38] W. Isard, Location and Space Economy (New York: Wiley, 1956), p. 20.

[39] R. F. Leggett, "Technology," Science and the North, citing N. B. Hutcheon, 1973, p. 226.

[40] Jean Chretien, "Plain Talk on Northern Development," Communique, DIAND, 12 June 1969, p. 3.

[41] Chretien, Ibid.

[42] "Transportation - North Western Canada's Key to Development," Edmonton Journal, 25 January 1973, passism.

[43] P. M. Manders, "A Rational Approach to Transport Planning for the Far North" (a paper presented to the Canadian Good Roads Association, 8 October 1970, Montreal).

[44] T. F. Wise, "Transportation Time versus Transportation Costs in Economic Development" (a paper presented to the Canadian Transportation Research Forum, 4 September 1966, Niagara Falls).

[45] J. C. MacPherson, Research Base for Development of a National Container Policy, Phase I (Ottawa: Canadian Transportation Commission, 1970), vol. 1-2, and, Swan Wooster Engineering Co. Ltd., Phase II (CTC, 1972), vol. 1-3.

[46] Z. Haritos, A Review of Marginal Cost Pricing (CTC, 1971), and Road Annual Costs and Revenues 1955-1968 (Ottawa: Information Canada, 1972), Catalogue no. TT72-1.

[47] M. F. Shaw, Truck Noise Reduction: A Review of Alternative Strategies (CTC, 1972).

[48] J. L. Courtney, Northern Air Transport Study (CTC, 1971), vol. 2.

[49] G. Mauzeroll, "Etude Comparative des couts de transport dans le Nord Canadien et des couts de transport sur les chemins de gravelle dans le reste du Canada," Au nord du 60° (Ottawa: Affaires Indiennes et du Nord, 1972).

CHAPTER 3

THE DEVELOPMENT OF ALL-WEATHER AND WINTER ROAD SYSTEMS

> *...transportation is not only a 'necessary' factor in any organized economy. It is also a 'limiting' factor in overall economic activity and developments as well as that of a particular region, industry, or firm. The availability of adequate transportation does not necessarily insure prosperity, but its absence guarantees economic stagnation.*[1]

Historical Background

All-weather and winter road developments in the Mackenzie Valley have passed through several stages of construction and utilization (Table 1). Before 1940, only a few miles of permanent roads existed in the Valley, and most roads were poorly constructed and maintained. The earliest roads were designed as portage trails around natural obstacles on the major northern water transportation routes or to meet local requirements in the northern settlements (e.g., Fort Smith - Fort Fitzgerald portage, and around the St. Charles Rapids on the Great Bear River).

In the early thirties, the Canadian Government

TABLE 1

PHASES OF ROAD CONSTRUCTION IN THE MACKENZIE VALLEY PRIOR TO 1940 TO THE PRESENT DAY

	Years of Construction	All-Weather and Winter Road Facilities Constructed or Improved	Miles
		All-weather roads;	
Phase I			
	1930-35	Fort Smith Portage	16
Prior to 1940	1932-36	Great Bear Portage	9
		Local roads in settlements	25
		Winter roads;	
	1938-39	Grimshaw--Great Slave Lake	350
		All-weather roads;	
	1942	Fort Smith--Bellrock	8
Phase II	1942-44	Canol Road	195
1942-45		Winter roads;	
	1942-43	Fort Nelson-Fort Simpson	200
	1942-43	Hay River--Norman Wells	425
	1942-43	Hay River--Fort Smith	125
		All-weather roads;	
	1946-48	Mackenzie Highway	400
	1956-60	Yellowknife Highway	280
	1958-61	High Level--La Crete--Fort Vermillion	160
	1957	Fort Providence	2
Phase III	1959	Fort Rae	7
1946-62		Winter roads;	
	1956-60	Hay River--Yellowknife	300
	1957	Rayrock Mines	40
	1958	Snare River	10
		Fort Smith--Talston River	60
	1960	Discovery Mines	65
	1961	Taurcanis	200
	1962	Camlaren	45
	1962	Marian River--Great Bear Lake	350
		All-weather roads;	
	1963-66	Hay River--Fort Smith	188
	1962-73	Ingraham Trail	60
Phase IV	1966-69	Kakisa Junction--Fort Simpson	192
	1970	Pine Point--Fort Resolution	43
	1971-73	Fort Simpson--Camsell Bend	40
1963-73	1970-73	Inuvik--Fort McPherson	85
	C.1965	High Level--Rainbow Lake	75
		Winter roads;	
	1965-	Edzo--Great Bear Lake	350
	1965-	Fort Simpson--Inuvik	725
		Total--All-weather roads...	1,785
		Total--Winter roads...	2,895

Sources: W. C. Wonders, "Roads and Winter Roads in the Mackenzie Valley Area," p.8.

J. W. Mackay, "Truck Transportation to Yellowknife--The Economic Effect on Inventories," a paper presented at the Alberta and Northwest Mining Meeting, Edmonton, 23 February 1962.

Pers. interview, L. Peterson, Superintendent, Department of Public Works, Fort Smith, July, 1973, and R. Loftus, Supply Department, Government of the Northwest Territories, Yellowknife.

began to take a greater interest in the northern territories, which was in part, a result of several valuable mineral discoveries in the area shortly after 1930.[2] Mining activity and exploration created greater demands on transportation services in the Valley and necessitated improvement of the facilities available. Between 1930 and 1936, the federal government reconstructed the St. Charles portage road on the Great Bear River,[3] and co-operated with private operators to improve the sixteen-mile portage road[4] between Fort Fitzgerald and Fort Smith on the Slave River. The Fitzgerald portage road was heavily used from the late nineteenth century.[5] Pitch blende and silver-ore prospects in the Port Radium area, and gold discoveries at Yellowknife, created an unprecedented demand for freighting services. The Hudson's Bay Company began operating a fleet of motor-car Trucks (Plate 1) equipped with boat trailers in 1930 to improve the efficiency of the Fitzgerald portage operations.[6] In 1935, the Northern Transportation Company Ltd., a Crown Corporation, assumed responsibility for the maintenance and operation of the portage road.[7]

Before 1940, winter road construction and operation were restricted by the capacity and quality of tracked equipment available.[8] Several attempts were made in the thirties to supply mineral properties around

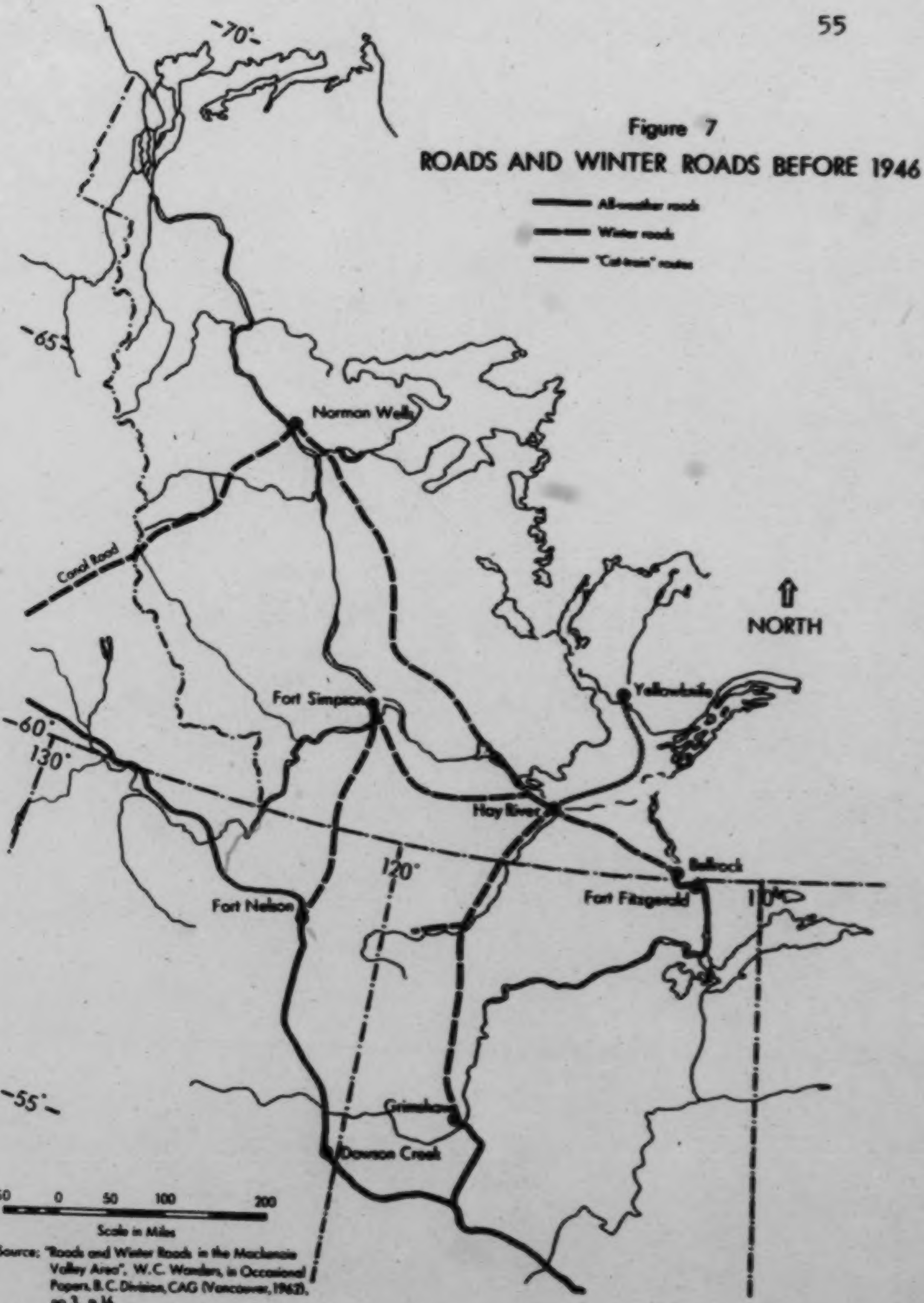
Plate 1. Typical example of the type of truck and trailer combination used on the Hudson's Bay Company portage at Fort Fitzgerald about 1920.

Yellowknife and on the north shore of Lake Athabasca by winter "cat-trains."[9] However, most of the early operations were handicapped by equipment losses, high insurance premiums, and the short operating season. Freight charges on winter cat-trains tended to be five-to-seven times the cost of marine transport,[10] and very few clients could justify this expense except for vital supplies.

The first major overland winter-road[11] operation in the Mackenzie Valley was attempted in 1939 from the railhead at Grimshaw, Alberta to Yellowknife, a distance of some 630 miles (Figure 7). The federal and Alberta governments cooperated on this scheme to move a large volume of vital supplies destined for Yellowknife which had been left at Waterways, Alberta by an early closure of the Athabasca water transport system in the fall of 1938.[12] The 1939 "cat-train" operation was successful, but many private operators involved in the project remained skeptical of the viability of winter road services without heavy government subsidies. After 1939, the winter route across Great Slave Lake to Yellowknife was not heavily used.

The second stage of road development in the Canadian North was catalyzed by external forces. The Japanese attack on Pearl Harbour in December 1941 necessitated strategic installations and developments in

Figure 7
ROADS AND WINTER ROADS BEFORE 1946


All-weather roads
Winter roads
"Cat-train" routes
70°
65°
60°
130°
120°
110°
55°
Norman Wells
Canol Road
Fort Simpson
Yellowknife
Hay River
Bellrock
Fort Fitzgerald
Fort Nelson
Grimshaw
Dawson Creek
NORTH
50
0
50
100
200
Scale in Miles

Source: "Roads and Winter Roads in the Mackenzie Valley Area", W.C. Wonders, in Occasional Papers, B.C. Division, CAG (Vancouver, 1962), no. 3, p.16.

Northwest North America. Additional airstrips were constructed throughout the Northwest to improve communication in the region. In 1942, the Alaska (Alcan) Highway was built to connect remote Alaska with central North America.

In an effort to ensure an uninterrupted supply of petroleum products for American Air Force installations in central Alaska and the Aleutians, the ambitious Canol Project[13] was undertaken in 1942. Several winter roads were constructed in the Mackenzie Valley at great expense to move pipeline construction supplies into the Norman Wells area as rapidly as possible. As well, a rough 500-mile service road was constructed parallel to the Canol pipeline between Norman Wells, N. W. T. and Johnson's Crossing in the Yukon Territory (Figure 7).

The Canol Road and pipeline were maintained and operated until 1945, but they were abandoned[14] soon after the Japanese surrender. Since 1965, the Yukon portion of the Canol Road has been rebuilt and maintained during the summer months to provide access to promising mineral properties near the Yukon - N. W. T. border. The Northwest Territories portion of the road is impassable today, although some sections of the route have been used for winter access and seismic tests by mineral developers in the past decade.[15]

The portage road between Fort Fitzgerald and Fort Smith was improved by army engineers during the War, and the northern terminus of the portage was extended eight miles downstream to Bell Rock.[16] New freight-handling and docking facilities were installed at both ends of the portage (Plate 2) and several studies were conducted to test the feasibility of constructing locks around the series of rapids below Fort Fitzgerald.[17]

After 1945, private operators and government agencies, encouraged by the success of the war-time operations, began to seriously consider the feasibility of ambitious all-season and winter road projects. Between 1946 and 1962 more than 200 miles of all-weather roads and 750 miles of winter roads were constructed in the Mackenzie Valley area. During this third stage of development, the basic structure of the Mackenzie Valley highway system was determined, and the two most important "links" in the system were completed -- the Mackenzie Highway (1946-48) and the Yellowknife Highway (1958-60).

The Mackenzie Highway, which connects Grimshaw, Alberta and Hay River, Northwest Territories, was completed in 1948 at a cost of approximately four and one-half million dollars.[18] The highway followed the original 1939 winter route to Great Slave Lake as far as Louise

Plate 2. Aerial view of the Northern Transportation Company, Bellrock installation north of Fort Smith and below the Pelican Rapids on the Slave River. The Bellrock facility and the Fort Smith-Slave River leg of the NTCL system have not been used since 1967. NTCL does plan to move heavy construction equipment for the Athabasca Oil Sands development via this route in the future.

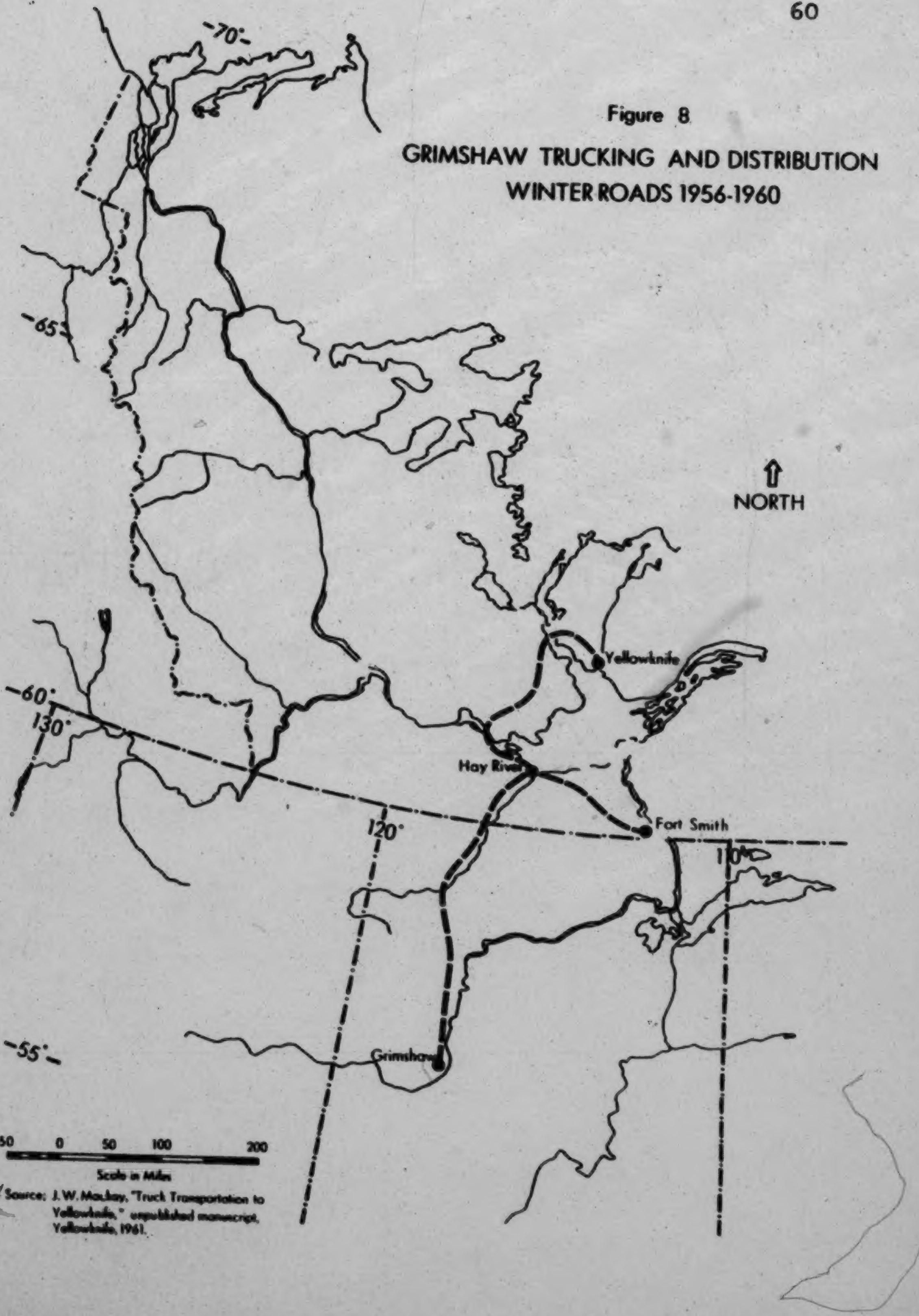
Falls on the Hay River. From Louise Falls, the Mackenzie Highway continued north twenty miles to Hay River, while the winter route veered east at the base of Louise Falls and ran north and east to reach Great Slave Lake at the mouth of the Buffalo River.

Between 1948 and 1956, private trucking operators offered regular service on the Mackenzie Highway "... but as this highway was not much more than a tote road (a rough access road constructed for short-term use and to minimum standards), it took a great toll of trucks and operators' finances."[19] General freight bound for Yellowknife was shipped by barge from Hay River in the summer months, and hauled across Great Slave Lake by tractor trains or snowmobiles[20] in the winter.

In 1956, Grimshaw Trucking and Distribution attempted the first overland winter trucking operation to Yellowknife. The Grimshaw operation was moderately successful and in the following years was extended to service Rayrock Mines and the Snare River Power Project (Figure 8). During each season of operation, the tonnage hauled to Yellowknife and other points on the route increased from 792 tons in 1956 to 3,448 tons in 1959.[21] By purchasing more efficient equipment, the annual construction and maintenance costs of the route remained at about thirty-five thousand dollars annually. Late

Figure 8

GRIMSHAW TRUCKING AND DISTRIBUTION WINTER ROADS 1956-1960


70°
65°
60°
130°
120°
110°
55°
Yellowknife
Hay River
Fort Smith
Grimshaw
NORTH
50
0
50
100
200
Scale in Miles

Source: J. W. MacKay, "Truck Transportation to Yellowknife," unpublished manuscript, Yellowknife, 1961.

in 1956, encouraged by the success of Grimshaw's winter operation, the federal government began to lay plans for the construction of the Yellowknife Highway.

The Yellowknife Highway is about 200 miles long and connects with the Mackenzie Highway system at Kakisa Junction, 60 miles west of Enterprise, Northwest Territories (Enterprise is 28 miles south of Hay River on the Mackenzie Highway). Completed in the fall of 1960, at a cost of about twelve million dollars, the Yellowknife Highway obviated the need for winter road and tractor-train operations between Hay River and Yellowknife.

Following the completion of the Yellowknife Highway, several winter trucking operations developed to supply mining operations and claims north of Great Slave Lake. Some of the most important winter roads constructed after 1960 included routes to the Discovery, Taurcanis, Camlaren, and Hidden Lake Mines; northeast of Yellowknife. The routes, mileage, and years of operation for these winter roads are shown in Figure 9.

In 1962, Byers Transport[22] constructed a 350-mile winter tote-road to the Port Radium Mine site to haul three diesel generators from the abandoned mine[23] south to Yellowknife and then northeast to Taurcanis in the Barrens. During the same period of time, Grimshaw

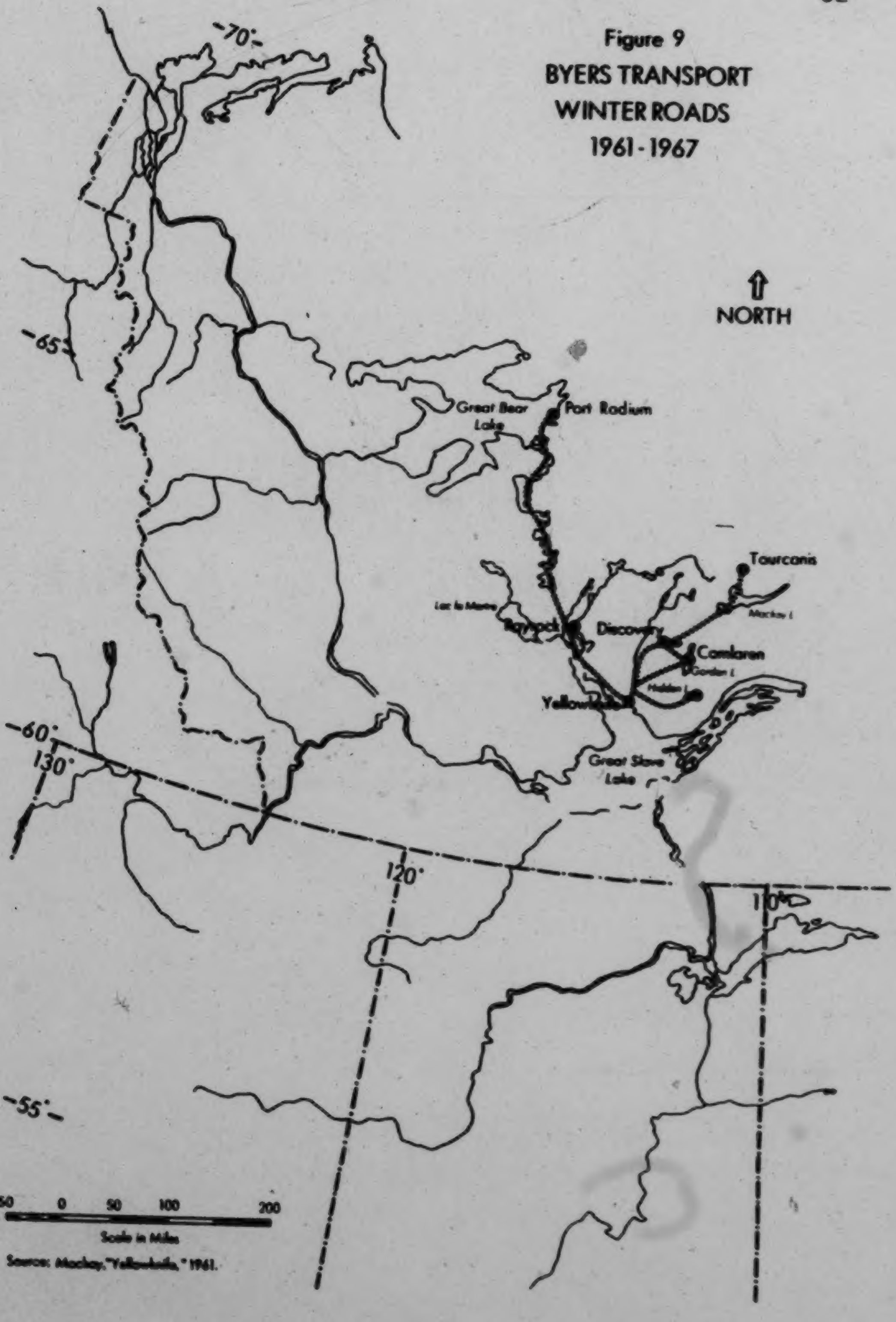


Figure 9
BYERS TRANSPORT
WINTER ROADS
1961-1967

70°
65°
60°
130°
120°
110°
55°
NORTH
Great Bear Lake
Port Radium
Tourcanis
Mackay L
Lac la Martre
Rayrock
Discovery
Camlaren
Gordon L
Hidden L
Yellowknife
Great Slave Lake
50 0 50 100 200
Scale in Miles

Source: Mackay, "Yellowknife," 1961.

Trucking and Distribution initiated scheduled winter road service from Hay River to Fort Smith. Other regular operations were established following original World War II winter routes to Fort Simpson and farther north parallel to the Mackenzie River.

In the early sixties, Bell Brothers in Fort McMurray, Alberta, provided sporadic service dependent upon demand, from Fort McMurray, Alberta to Uranium City and points on Lake Athabasca.

Since 1962, the all-weather road system in the Mackenzie Valley has been continually improved and extended. In the past decade, the emphasis on road construction has been to connect isolated communities and areas of proven resource potential with the "backbone" formed by the Yellowknife and Mackenzie Highways. Accordingly, in 1966, the 200-mile all-weather highway system between Hay River, Pine Point and Fort Smith was completed, and by 1970, Fort Simpson and Fort Resolution had been connected with the Mackenzie Highway system.

Work has also been continuing on the Ingraham Trail east of Yellowknife since 1962. The Ingraham Trail, which is now about fifty miles long, was originally designed to provide mining operations on Gordon and Mackay Lakes with all-season access, but the depletion of viable ore resources in the Taurcanis and Discovery Mines in 1967 forced a slow-down on the project. Present long-range road plans include a proposal to extend the Ingraham Trail around the eastern arm of Great Slave Lake to Fort Smith by 1976.[24] However, it seems unlikely that such an expenditure is warranted on the basis of mineral potential or existing service requirements in the area.

The initial importance of winter road transport has gradually decreased since 1962, in part because of the expanded all-weather road network, but also as a result of the increased competitiveness of modern heavy air freighters.[25] However, two important winter routes have been used in the Valley during the last decade. Each season since 1965, Pacific Western Trucking has established a 350-mile winter road (Figure 10) between "Fort Byers" on the Yellowknife Highway (one mile west of Edzo) and Echo Bay Mines on Great Bear Lake (Plate 3). General mine supplies are moved north and high grade silver ore and concentrate are backhauled. The Pacific Western road roughly follows the original route established in 1962 by John Dennison of Byers Transport.[26] Isolated native communities at Rae Lake and Lac La Marte, the Snare River Power Station, Terra Mining on Clutt Lake, fishing lodges on Great Bear Lake, and several private exploration parties have been served from the Pacific

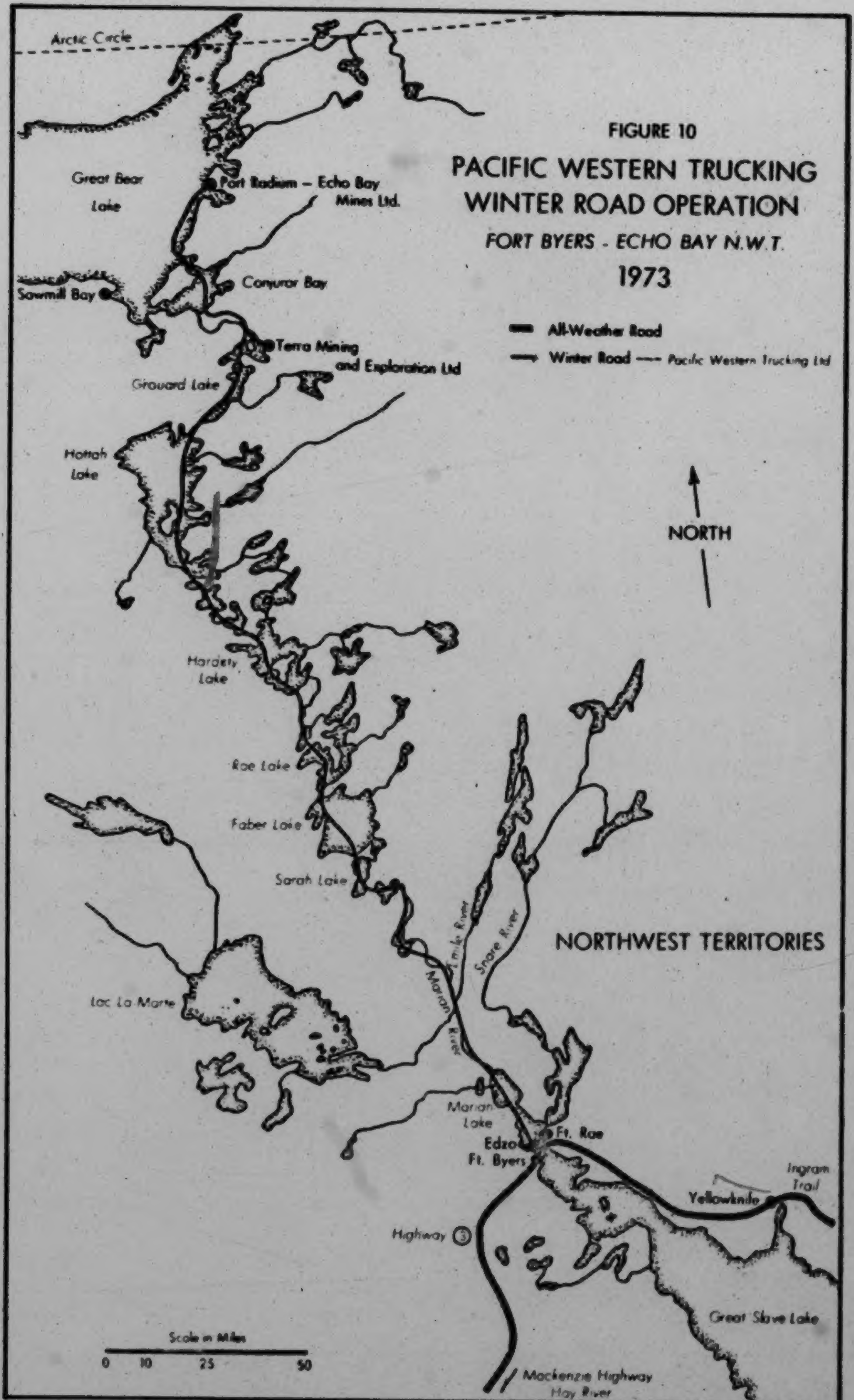


FIGURE 10

PACIFIC WESTERN TRUCKING WINTER ROAD OPERATION

FORT BYERS - ECHO BAY N.W.T.

1973

All-Weather Road
Winter Road — Pacific Western Trucking Ltd
Arctic Circle
Great Bear Lake
Port Radium – Echo Bay Mines Ltd.
Sawmill Bay
Conjuror Bay
Terra Mining and Exploration Ltd
Grouard Lake
Hottah Lake
NORTH
Hardisty Lake
Rae Lake
Faber Lake
Sarah Lake
Emile River
Snare River
Marian River
NORTHWEST TERRITORIES
Lac La Martre
Marian Lake
Ft. Rae
Edzo
Ft. Byers
Ingram Trail
Yellowknife
Highway 3
Great Slave Lake
Scale in Miles
0
10
25
50
Mackenzie Highway
Hay River

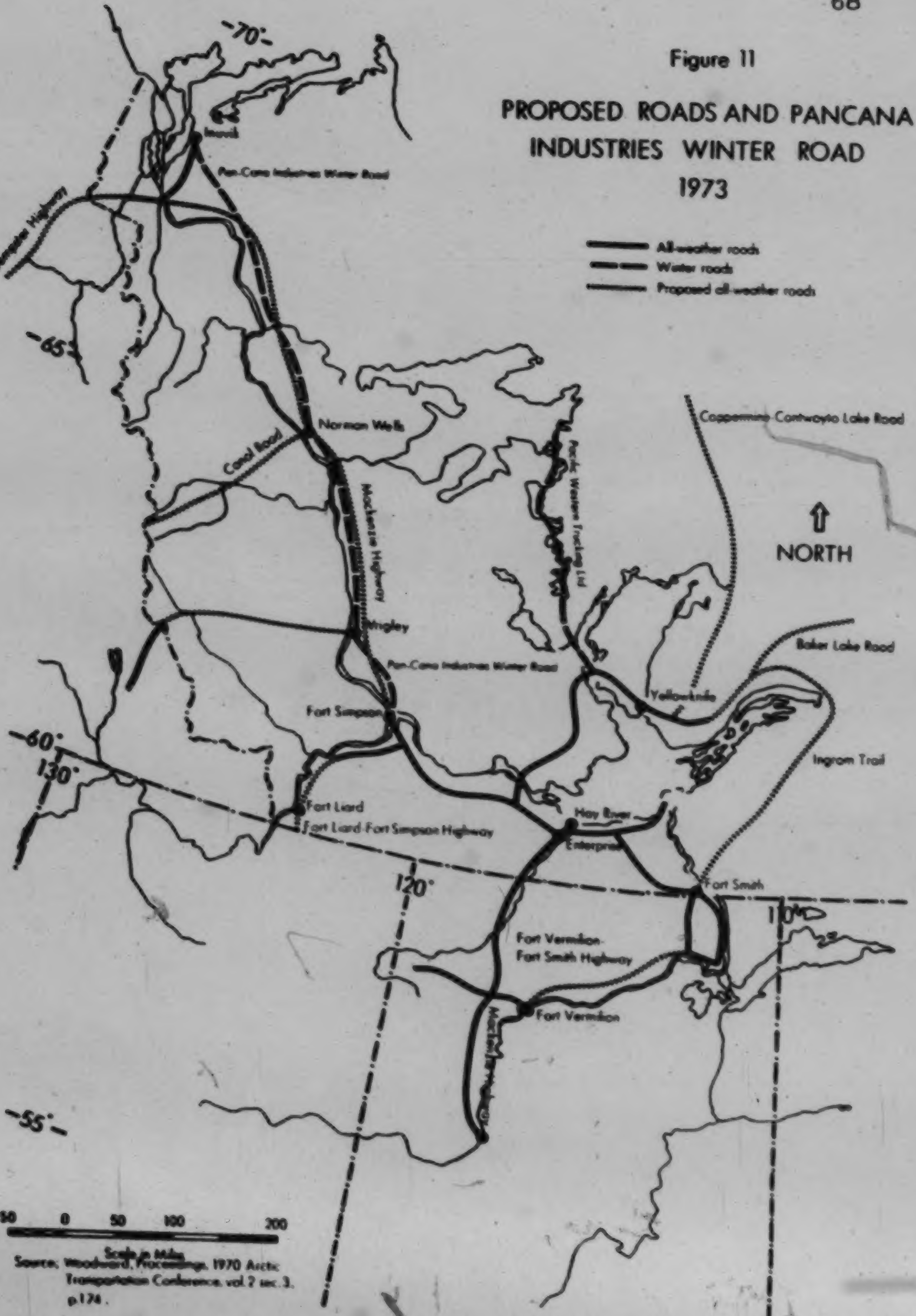
Plate 3. Echo Bay Mines Limited, Port Radium, Great Bear Lake--1973.

Western winter road in recent years.[27]

The second major winter road operation in the Valley is operated by Bain Brothers Construction for PanCana Industries of Calgary. This road was first opened in 1964 when Canadian National Telecommunications cleared a right-of-way between Fort Providence and Inuvik, N.W.T. for the emplacement of a communications landline between these two points.[28] In the following year, Calgary Exploration Services Limited (Calex) began operating a winter road over the right-of-way (Figure 11). In 1968, Calex was granted a lease of right-of-way which provided the first legal basis for the Company to exact tolls from commercial and industrial users.[29] Since 1970, the 735-mile winter road operation has been managed by PanCana Industries Limited.[30] The route is intended to serve the needs of the oil, gas and mining exploration interests, but under an obligation with the Department of Indian Affairs and Northern Development, PanCana must allow private and government vehicles free passage. Commercial carriers are presently charged four cents per ton-mile for access. Oilfield and heavy equipment haulers have been the biggest users of the road, but some common carriers, including Hay River Truck Lines and Pacific Western have used the service to supply customers in Norman Wells,[31] Fort Good Hope,[32] and Mackenzie Highway construction camps.[33]

Figure 11

PROPOSED ROADS AND PANCANA INDUSTRIES WINTER ROAD 1973


All-weather roads
Winter roads
Proposed all-weather roads
70°
65°
60°
55°
130°
120°
110°
Inuvik
Pan-Cana Industries Winter Road
Dempster Highway
Norman Wells
Canol Road
Mackenzie Highway
Wrigley
Pan-Cana Industries Winter Road
Fort Simpson
Fort Liard
Fort Liard-Fort Simpson Highway
Pacific Western Trucking Ltd
Coppermine-Contwoyto Lake Road
NORTH
Baker Lake Road
Yellowknife
Ingram Trail
Hay River
Enterprise
Fort Smith
Fort Vermilion-Fort Smith Highway
Fort Vermilion
Mackenzie Highway
50
0
50
100
200
Scale in Miles

Source: Woodward, Proceedings, 1970 Arctic Transportation Conference, vol.2 sec.3, p.174.

The Federal Government has developed a series of programs and policies to provide a comprehensive road network "... to serve the needs of the northern residents and the development of the resources of the North."[34] Major improvements and extensions to the Mackenzie Highway system in the last decade are a result of these Federal programs. However, the recent escalation of mineral and hydrocarbon exploration in the Mackenzie Valley has necessitated the formulation of a more flexible northern road development program, designed to provide access at minimum "cost"[35] into undeveloped areas of favourable natural potential. The new policy, approved on December 21, 1971, is designed to foster more than rapid exploitation of our northern resources. The new policy provides for "... conservation measures that will further protect the northern land environment and minimize surface disturbance from transportation operations."[36] The recognition of the environmental and social implications[37] of road access in the Mackenzie Valley signals the beginning of a fourth stage of northern highway development.

In 1973, almost all communities and mine sites in the area are served by all-weather or winter road facilities. It appears certain that future road extensions will have to be justifiable on more than economic criteria. The pace of construction on a 700-mile section of the Mackenzie Highway from Fort Simpson to Inuvik has been retarded dramatically as a result of pressure from ecology-conscious citizens and environmental groups.[38] As well, progress on plans to extend the Fort Vermillion road through Wood Buffalo National Park has been held up by opposition from the National Parks and native land claims. The success of native and environmental groups in their efforts to ensure the rational development of northern roads at minimum cost to the northern environment, helps to ensure that northern road development in the seventies will involve a consideration of all the alternatives. In the future, developers will be accountable to the Canadian public.

Due to the highly speculative nature of many road proposals in the Mackenzie Valley such as extensions to the Cantung Road (Figure 7) and construction of roads to Coppermine or east through the Barrens to Baker Lake, any consideration of the effect of these roads on motor carrier operations is best reserved for the concluding chapter of this thesis.

Northern Road Construction, Operation, and Maintenance Problems

Expansion of the transportation facilities in the Canadian Northwest during the early 1940's created many unique construction and design problems. Before 1940, little was known in North America about the problems of construction in permafrost[39] and, as a result,

> *... the engineers and contractors involved in these undertakings in Yukon Territory and Western Mackenzie District were unaware of the existence of permafrost, construction methods similar to those used in temperate regions were employed.*[40]

Since the Second World War, permafrost engineering and construction studies have received considerable emphasis, in an effort to avoid the expensive mistakes which plagued wartime projects, and caused many unforeseen problems. The precautions taken to avoid construction, maintenance, and operation difficulties associated with permafrost vary according to the nature of terrain crossed, the type of road constructed and, of course, the extent of permafrost in the region.

The most important element of road construction in permafrost areas is a detailed reconnaissance of the region to select the optimum route. R. J. Brown, one of the Canadian authorities on construction in permafrost, concludes that "... the shortest route may not necessarily be the best."[41] Although it may not always be possible, soils and fine-grained sediments which contain a high proportion of water or ice should be avoided, and consideration should be given to the location of suitable supplies of granular road material adjacent to the route.[42]

Most northern roads are used for heavy truck hauling, which further complicates the designer's task. The low traffic volume typical on northern routes does not justify heavy expenditures, but the heavy axle loadings require a durable roadbed. Zapf has pointed out that in most instances the "... design becomes a compromise between economy and durability."[43] Zapf concludes;

> *The problem will continue to face engineers taking part in the development program. The very nature of the type of development and resources suggest the movement of heavy equipment and materials. Consequently, while the aim will be to keep the costs to a minimum, the cheapest road will not necessarily be the best solution.*[44]

Considerations of the alignment and grade are rarely a problem in the sedimentary zone of the Mackenzie Valley, but in the mountainous zone west of the Mackenzie River and in the Precambrian Shield, the grade should never exceed ten per cent,[45] and curves should be very gradual to accommodate long tractor-trailer units with long-turning radii. Minimization of grades and curves may involve considerable blasting and filling which greatly increases the cost of road construction. Work on a sixty mile section of the Yellowknife Highway west of Yellowknife in the Precambrian zone cost about sixty thousand dollars a mile compared to twenty thousand dollars a mile in the sedimentary zone, where fewer curves were required, good road building material was locally available,[46] and steep grades were not a problem. Perhaps as a compensation, permafrost conditions do not represent a significant problem in the solid bedrock of the Shield.

In the continuous permafrost zone, engineers must endeavour to prevent any disturbance of the normal thermal regime. Insulation methods of construction are employed and the road-bed is usually constructed directly over the surface vegetation during winter. Right-of-way clearing, surveying, ditching, and culvert construction should also be done during the winter months since:

> *... any unnecessary disturbance of the surface cover will introduce serious problems both during construction and after due to increased thawing of the permafrost.*[47]

The most effective method of insulation has been to preserve the natural vegetative cover and place as thick a "pad" of coarse-grained granular material beneath the road-bed as possible. The depth of cover required to prevent thawing and subsidence depends upon a variety of local factors, but generally three feet is regarded as a minimum. In the past few years, several experiments have been conducted to test the effectiveness of artificial insulation in road-beds built over continuous permafrost. Many of the results have been encouraging. At Inuvik, for example, three inches of styro-foam underlay was found to provide an insulative effect equivalent to three feet of coarse gravel.[48]

Construction in the zone of discontinuous permafrost is complicated by problems of locating and determining the extent of permafrost within the zone. Roads constructed in the discontinuous zone may encounter permafrost conditions dozens of times within a few miles, which necessitates special engineering considerations, and greatly increases construction costs. Failure to identify sporadic occurrences of permafrost along the route may jeopardize the integrity of the road-bed. Wherever high ice content soils are encountered in the continuous or discontinuous zones, the frost-susceptible soils are excavated and the excavations back-filled with coarse-grained granular materials.

Drainage represents one of the major maintenance problems on northern roads. In general, however, recognition of likely problems during the planning stage, and adequate provision of facilities prior to operation of the road will eliminate later complications by "icings" and subsequent erosion. An effort should be made to divert the major flow of water so that it runs parallel to the road. Where this is impractical, the culvert installed should allow for excess capacity, and be buried deep in the road-bed early in the summer. Brown points out that deep frost penetration and subsequent erosion on thawing in the ditches parallel to the road can be prevented by filling them with snow. This precaution has been used on the Mackenzie and Yellowknife Highways with success.

"Icings" are caused when obstructions to the natural or sub-surface drainage cause water to collect on the surface and freeze. On the Alaska Highway, which was improperly constructed in many areas of heavy surface and underground drainage, icings over fifteen feet thick and many hundreds of yards long have developed some seasons. Some icings may have to be removed by blasting, but normally, in the Mackenzie Valley, they seldom exceed a few inches in depth, and rarely impair normal operations on the highway network. Sanding or scarification with graders may be required on some slopes.[49] Lotspeich[50] and Thompson[51] provide good discussion of the various measures which have been used to control or prevent the development of icings on northern highways.

Winter road construction and operation is generally much cheaper and, as a rule, fewer design or construction procedures are required compared to all-weather road developments. However, care must be exercised, especially in regions of fine-grained, high-ice content sediments, to minimize damage to the protective vegetative surface cover which could result in thawing and subsidence in the summer following operation. Proper route selection is necessary to facilitate rapid construction during the very short operating season, and also to insure the economic operation of the winter road.

In the Precambrian Shield, every effort is made to travel on frozen lake or river surfaces to minimize blasting expenses and obtain a favourable grade. Whenever portages are unavoidable, the number of switch-backs and steep grades, which slow down the truck convoys and create hazardous conditions, is kept to a minimum, even if elimination greatly increases the length of the route. Plowing and compacting operations usually begin in the first week of January and are completed by the end of the month (Plate 4). The hauling season usually lasts until the end of March in the Mackenzie Valley, although conditions vary considerably throughout the area and from year-to-year.

Plate 4. Winter road construction operations--1973. The two Versatile four-wheel drive tractors shown on the left are used to maintain Pacific Western Trucking Division's 350-mile winter road from Edzo to Echo Bay Mines on Great Bear Lake. The unit on the right is a White, six-wheel drive cab-over tractor, which simultaneously pushes a ten-foot vee-plow, and pulls a 72,000 pound payload.

Winter-road facilities have contributed to the improved efficiency and economic operation of many remote mineral developments and exploration projects throughout the Mackenzie Valley. Winter roads can be constructed and maintained at a fraction of permanent land access costs,[52] and with proper supervision and precautions, minimize disturbance of the Arctic and sub-Arctic environments. Until greater resource potential has been proven in the area west of the Mackenzie River, winter haul services will continue to represent the most viable and rational selection of alternatives available.

Mackenzie Highway Traffic Measurements[53]

Reliable estimates of daily or annual vehicular traffic flows on the Mackenzie Highway and other territorial road systems are very difficult to obtain. The Alberta Department of Highways maintains a continuing record of vehicle movements on the Mackenzie Highway south of the sixtieth parallel (Table 2). Analyses of these records shows a rapid northward decrease in the average daily traffic flow on the Mackenzie Highway. Also, the proportion of trucks to private vehicles using the highway increases northwards towards the sixtieth parallel (Figure 12).

The only estimates of daily traffic flows for the highway system north of sixty degrees are provided

TABLE 2

VEHICULAR TRAFFIC FLOW DATA FOR THE ALBERTA SECTION OF THE MACKENZIE HIGHWAY--1972

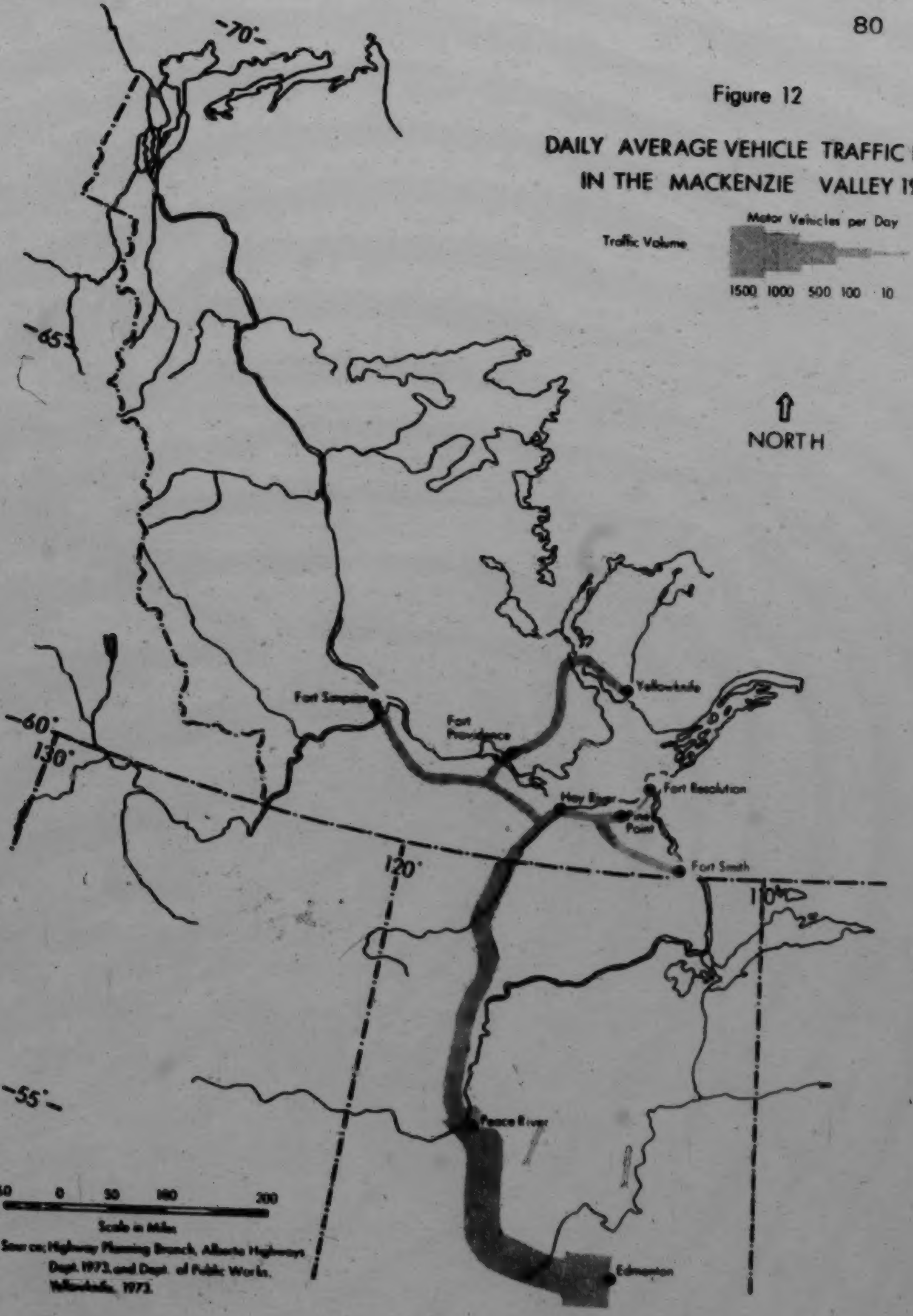
Location on Mackenzie Highway	Average daily flow[a] (Northbound only)				
	Private Vehicles	Buses	Single-unit Trucks	Truck-Trailer Combinations	Totals
Grimshaw (Mile 0)	635 (73.0)	12 (1.4)	108 (12.4)	116 (13.2)	871
Manning (Mile 52)	452 (77.5)	7 (1.7)	50 (8.6)	71 (12.2)	580
High Level (Mile 174)	227 (69.8)	4 (1.2)	52 (15.8)	43 (13.2)	326
60th Parallel (Mile 292)	66 (64.0)	2 (0.4)	12 (11.8)	25 (23.8)	105

Sources and Notes: [a] The values given are "units per day." The values in parentheses indicate the vehicular composition of traffic at each location as a percentage (%) of total daily flow.

[b] Pers. communication, J. Marko, Department Statistician, Planning Branch, Alberta Highways and Transport Department, Edmonton, October 1973; and, D. D. Kuchinski, Traffic Planning Engineer, Alberta Highways, Edmonton, 19 November 1973.

Figure 12

DAILY AVERAGE VEHICLE TRAFFIC FLOWS IN THE MACKENZIE VALLEY 1973


Motor Vehicles per Day
Traffic Volume
1500 1000 500 100 10
NORTH
70°
65°
60°
55°
130°
120°
110°
Yellowknife
Fort Simpson
Fort Providence
Fort Resolution
Hay River
Pine Point
Fort Smith
Peace River
Edmonton
50 0 50 100 200
Scale in Miles

Source: Highway Planning Branch, Alberta Highways Dept. 1973, and Dept. of Public Works, Yellowknife, 1973.

by Leggett[54] (Table 3). Since there are no figures available which might provide a basis for comparison, the accuracy of Leggett's values cannot be checked. However, some indication of the composition of vehicular traffic on the Yellowknife Highway is given by the records of vehicular movements[55] at the Fort Providence ferry operation (Table 4). Leggett's values, together with information provided by the Territorial Public Works Department,[56] and sporadic traffic counts made in July 1973,[57] have permitted the generation of approximate daily vehicle flow for locations on the Mackenzie Highway system (Table 3).

It should be pointed out that the average daily vehicular flow and composition of traffic on routes in the Mackenzie Valley varies significantly from season-to-season. In general, the proportion of private vehicles increases to about seventy per cent of total flow during the tourist season (July and August), and declines to less than fifty per cent by late October. The average daily volume of vehicular traffic more than doubles in the summer months. The absolute number of commercial vehicles in the daily traffic flows does not vary greatly according to season, which seems to reflect generally stable demand for motor carrier service throughout the year.

TABLE 3

VEHICULAR TRAFFIC FLOW DATA FOR SELECTED LOCATIONS ON THE MACKENZIE HIGHWAY NETWORK, 1971-73

Location	Average daily flows (Northbound only)		
	1971	1972	1973
60th Parallel	96	105	120
Pine Point-Fort Resolution	15	16	16
Hay River-Pine Point	95	105	109
Junction 5 and 6 to Fort Smith	70	74	76
Kakisa Junction to Yellowknife	86	93	112
Kakisa Junction to Fort Simpson	80	86	95

Sources: R. Leggett, "Technology," Science and the North (Ottawa: Information Canada, 1972), C. 5, p. 223.

Pers. communication, J. R. Bentley, Department of Public Works, Yellowknife, 2 October 1973.

Traffic counts made at each location in July and August, 1973.

TABLE 4

NATURE AND VOLUME OF VEHICULAR TRAFFIC HANDLED AT FORT PROVIDENCE FERRY CROSSING, 1972-1973

Type of Vehicle	1972 Traffic Composition (%)			1973 Traffic Composition (%)
	May 28-Aug.	Sept.	Oct.-Nov.17	May 12-Aug. 31
Private	72.5	66.0	51.6	70.0
Bus	1.0	3.1	1.4	1.9
Truck	23.3	30.6	46.7	22.5
Other	3.2	0.3	0.3	5.6
Total	100.0	100.0	100.0	100.0
Average Number of Vehicles Per Day	125	117	63	133

Source: Pers. communication, J. R. Bentley, Department of Public Works, Yellowknife, 2 October 1973.

Based on the very rudimentary data presented above, and a consideration of the increase in freight traffic[58] handled by motor carriers in the Mackenzie Valley since 1969, it appears that the volume of vehicular traffic on most portions of the Mackenzie Highway network increased by approximately fifteen per cent between 1970 and 1973. In the future, dramatic increases in the total volume of vehicular traffic do not appear likely. For the short-term, at least, changes in the existing pattern and volume of flows will depend upon the location and pace of resource discovery or development.

FOOTNOTES

CHAPTER 3

[1] R. J. Sampson and M. T. Farris, Domestic Transportation: Practice, Theory and Policy (Boston: Houghton Mifflin Company, 1971), p. 85.

[2] Between 1930 and 1935 silver and pitchblende deposits were discovered along the eastern shore of Great Bear Lake in McTavish Arm, and the Yellowknife Goldfields were staked. Radium production began at Port Radium in 1933, and the Con Mines at Yellowknife first hoisted ore in 1938.

[3] K. J. Rea, *The Political Economy of the Canadian North* (Toronto: University of Toronto Press, 1968), p. 237.

[4] Rea, *Ibid*., p. 238.

[5] Petroleum exploration and refinery construction by the Imperial Oil Company at Norman Wells, necessitated the movement of large volumes of construction materials and general supplies before 1925.

[6] Pers. interview, Paul Kaesar, Sr., Fort Smith, N. W. T., August, 1973.

[7] Rea, *loc*. *cit*.

[8] Pers. communication, H. Loewen, Northern Operations Manager, Pacific Western Trucking, Edmonton, 5 April 1973.

[9] Caterpillar tractors equipped with snow blades and special grauzers were used to pull groups of cargo sleds (usually about five) mounted on skids or runners across the frozen lake surface.

[10] Pers. interview, K. L. Neal, General Manager, R. M. Williams Trucking Limited, Yellowknife, July 1973.

[11] Winter roads are constructed of compacted snow over land and across frozen lake surfaces each season (usually January to March in the Mackenzie Valley). For a discussion of winter road operation and construction, see, David R. Podmore, "Winter Road Operations," *North/Nord*, vol. XX, no. 6 (November-December 1973), pp. 16-19.

[12] Operations on the northern water transportation system were severely restricted by low water during several seasons in the late 1930's.

[13] Canol -- Canadian Oil Pipeline Project.

[14] Several sections of four inch pipe were salvaged from the abandoned Canol Pipeline about 1968, by a Vancouver scrap-metal dealer. Pers. communication, General Manager, Rowan Iron and Steel, Vancouver, January, 1969.

[15] Pers. communication, John E. Staples, President, McGregor-Johanson Contracting Limited, Edmonton, March 1973.

[16] Rea, Ibid., p. 252.

[17] All the early studies and several investigations since the War have concluded that the installation of any structure to facilitate navigation through the Fitzgerald rapids could not be economically justified, even on a long-term basis.

[18] R. F. Leggett, "Technology," Science and the North (Ottawa: CND, 1973), p. 225.

[19] J. W. McKay, "Truck Transportation to Yellowknife," unpublished manuscript courtesy of J. W. McKay, Purchasing Manager, Giant Yellowknife Mines Ltd., Yellowknife, 1961, p. 2.

[20] Military-style "Bombadiers" were used instead of caterpillar tractors on several runs with considerable success. Although the Bombadier has less power than a caterpillar tractor, its speed and greater mobility was advantageous for short runs and especially in selecting a route for the less manueovrable "cat-trains" around pressure ridges or across faults in the ice.

[21] McKay, op. cit., p. 3.

[22] Byers Transport was purchased by Pacific Western Airlines in 1966. Pacific Western Trucking Ltd., a wholly-owned subsidiary of PWA, was formed as a result of the Byers purchase, and the acquisition of Monarch Trucking. PWT is managed by H. M. Trimble and Sons (Trimac), for PWA.

[23] The Port Radium Mine was closed on December 13, 1960 after twenty-five years of continuous operation by The Eldorado Mining and Refining Company (now Eldorado Nuclear Ltd.).

[24] T. W. Harwood, "Northern Roads," in Proceedings, Arctic Transportation Conference, vol. 2, sec. 3, 1970, pp. 151-180.

Plans by Giant Yellowknife Gold Mines to re-open the Camlaren operation on Gordon Lake, 40 miles northeast of Yellowknife, in the winter of 1974, could have an effect on plans to extend the Ingraham Trail.

[25] Many northern operators are finding that the reliability, versatility, and speed of modern air transport, outweight the disadvantage of higher unit costs for transportation. Also, air transportation charges per ton-mile have steadily decreased in the last decade with similar charges for all alternate modes of northern transport having increased several times (Chapter 5).

[26] See page 61.

[27] Robinson's Trucking Ltd. of Yellowknife assumed responsibility for the winter road service in April 1973 after a disagreement between Pacific Western Trucking and the management of Echo Bay Mines Limited, who are the major customers of the winter trucking operation.

[28] Pers. interview, J. Lane, Manager, Canadian National Telecommunications, Yellowknife, July, 1973.

[29] Pers. communication, A. T. Jordan, Northern Program Planning Division, DIAND, Ottawa, 20 August 1973.

[30] Calgary Explorations was purchased by Western Electronics and Engineering in 1970. Western Electronics subsequently changed its name to PanCana Industries Limited.

[31] Hay River Truck Lines made five runs to Norman Wells for Imperial Oil during the 1973 operating season. Pers. communication, Peter Graham, General Manager, Hay River Truck Lines, Edmonton, 10 October 1973.

[32] Pacific Western Trucking operated several units on the PanCana winter road in 1973. One load was carried to Fort Good Hope, the most northerly point served by a common carrier operator in the Mackenzie Valley that season. Pers. communication, Ron S. Small, Traffic Director, PWT, Edmonton, 11 October 1973.

[33] During the 1972 season, Hay River Truck Lines provided scheduled service over the winter route to resupply Mackenzie Highway construction camps between Fort Simpson and Camsell Bend. Pers. communication, P. Graham, 10 October 1973.

[34] Pers. communication, A. T. Jordan, Northern Program Planning Division, DIAND, Ottawa, 20 August 1973.

[35] That is, including a consideration of other "costs" not so easily quantified, such as environmental or social disturbances leading to changes.

[36] Jordan, op. cit.

[37] Several Communique by Jean Chretien, issued by the Department of Indian Affairs and Northern Development discuss the social and ecological consequences of northern development.

[38] Edmonton Journal, 1 September 1973, p. 19.

[39] Brown defines permafrost as "...a thermal condition of earth materials, such as soil and rock, when their temperature remains below 32°F continuously for a number of years." R. J. Brown, Permafrost in Canada (Toronto: University of Toronto, 1970), p. 3.

[40] *Ibid.*, p. 105.

[41] *Ibid.*, p. 107.

[42] There are many good deposits of suitable road materials along the proposed routes of the Mackenzie Highway. However, borrowing from many of the deposits may cause environmental problems such as silting and deposition in important fish spawning streams. Fine-grained soils containing a high proportion of water or ice occur extensively in the sedimentary regions of the Valley.

[43] N. R. Zapf, "Highway Location and Construction in the North," in Proceedings, British Columbia Natural Resources Conference, Harrison, 1959, p. 124.

[44] Zapf, *loc. cit.*

[45] Zapf, *loc. cit.*

[46] Road-bed fill has to be crushed in the Precambrian zone, although mine tailings and waste have been used in some areas.

[47] Brown, *op. cit.*, p. 108.

[48] Public seminar, R. J. Brown, "Construction Problems in Permafrost," Department of Engineering, University of Alberta, Edmonton, 19 February 1973.

[49] Pers. interview, L. Peterson, Superintendent, Department of Public Works, Fort Smith, August, 1973.

[50] F. B. Lotspeich, Environmental Guidelines for Road Construction in Alaska (College: Environmental Protection Agency, 1972).

[51] S. Thomson, "Icings on the Alaska Highway," in Proceedings of Permafrost International Conference, National Research Council Publication no. 1287 (U.S.), 1966, pp. 526-9.

[52] For example, the Fort Byers-Echo Bay winter route operated by Pacific Western Trucking is about 350 miles long and cost $60,000 for construction and maintenance in 1973. Average costs for the winter road operation have remained at about $225 per mile since 1965. All-weather road construction in the area would likely exceed $100,000 per mile.

[53] Here, "traffic" refers to the number of vehicles passing a specified point on a given highway within a certain period of time - NOT to traffic volume measured in tons or ton-miles.

[54] R. F. Leggett, "Technology," Science and the North (Ottawa: Committee on Northern Development, 1973), pp. 221-226.

[55] Pers. communication, J. R. Bentley, Chief, Highways Division, DPW, Yellowknife, 2 October 1973.

[56] Bentley, Ibid.

[57] Two 24-hour traffic counts were made at three locations on the Mackenzie Highway system during the field season -- July and August 1973. The locations were at the sixtieth parallel on the Mackenzie Highway, Kakisa Junction (Fort Simpson leg), and the junction of Highways 5 and 6 (Fort Smith leg).

[58] See Chapter 5, pp. 153-154.

CHAPTER 4

THE NORTHERN MOTOR CARRIER INDUSTRY IN THE MACKENZIE VALLEY TO-DAY

> *The Mackenzie Corridor is already a reality. Within its undefined borders flows the mighty Mackenzie River, the nation's second largest river transportation system. Soon the barges which ply its length will face competition from long-distance trucks rolling along the northward extension of the Mackenzie Highway. That much is certain.*[1]

GENERAL FEATURES

Roberts' prediction is based on historic fact. Throughout the Canadian North, with each extension of the northern highway system, motor carrier transportation has assumed an important role in the process of goods distribution. Truck transport has almost totally removed the original dependence on water transport for bulky and heavy cargoes in the Southern Mackenzie and has minimized the inconvenience of seasonal shipping in all areas accessible by road. Despite tremendous advances in the last decade, compared to northern air or water transport, and to conventional[2] trucking in southern Canada, the northern motor carrier industry is unsophisticated and generally immature. Northern motor carriers operate under unique geographic constraints which affect the economics and methods of trucking operations in the region.

Operating Authorities

The rapid evolution of the northern motor carrier industry, which has closely paralleled the development of all-weather roads in the Mackenzie Valley, has necessitated the formulation of more stringent operating regulations and motor vehicle legislation. An understanding of northern public service vehicle ordinances is essential to an examination of the northern trucking industry. Vehicle regulations and policies in the Northwest Territories are often less rigid than regulations in southern Canada, and until recently, the most conspicuous characteristic of northern motor carrier legislation has been the lack of it.[3]

Motor carrier operations in the Mackenzie Valley were not properly controlled until the completion of the Mackenzie Highway in 1949. Prior to the Highway's construction strict public service vehicle regulation was both impractical and unnecessary. Early trucking operations -- with the exception of winter-road hauling -- were confined to communities on the major water routes and to portage operations.

George Pinsky, a fur trader and general merchant in

Fort Resolution, is credited with owning the first vehicle in the Northwest Territories. In 1923, Pinsky purchased a Model-T Ford half-ton to carry furs from the Fort Resolution dock to his store.[4] About the same time, the Hudson's Bay Company purchased a fleet of Motor-Car flat-bed-trucks for use on the Fort Fitzgerald portage. Later, trucks were used in the construction of gold-mines near Yellowknife and at the Imperial Oil refinery in Norman Wells. During the Second World War, the number of vrhicles employed in the region increased dramatically, as military and civilian contractors joined forces for the construction of the Canol Pipeline.[5] Before 1950, however, most motor vehicles were confined to operations in the scattered settlements and to winter-road services.

In the last two decades, trucking operations have become highly specialized in the Mackenzie Valley. Special services exist in every community to meet the needs of the construction, mining, and exploration industries, and to serve other customers in the settlements.

Motor carrier operations can generally be divided into "public service" and "commercial" vehicle operations. A public service vehicle is;

> *...a motor vehicle or trailer that is operated by or on behalf of any person for gain or reward.*[6]

Commercial vehicles include motor vehicles which are;

> *...owned by a municipality or school district*
>
> *...used by its owner for the distribution of goods manufactured or sold by him*
>
> *...leased or rented and not used as a common carrier.*[7]

Public service vehicle operations fall into two main categories -- "common" and "contract." Public service vehicle operating authorities -- the right to operate a for-hire service and to exact a charge for transportation services provided -- are granted on the basis of the type of carrier service provided. Common carriers are;

> *...those firms who hold themselves out to the general public to engage in the transport of property over regular or irregular routes.*[8]

Common carriers, according to the regulations set down in the Public Service Vehicles Acts for Alberta and the Northwest Territories, must provide general freight services to all customers in the area where the firm is licensed to operate. Further, common carriers must accept all freight and cannot restrict their services to specific customers, commodities, or on the basis of volume.

Contract carriers are not responsible to the general public and include;

> *...those firms under continuing contracts, with one or a limited number of persons or firms, either for the furnishing of transportation service for the exclusive use of each person served or distinct services designed to meet the needs of various customers.*[9]

Common Carriers

In Northern Alberta and the Northwest Territories less than five per cent of the licensed operators could be classed as "common carriers" (Table 5). Common carrier operations in the Mackenzie Valley are restricted to firms which operate regular general freight runs to settlements and mine centres accessible by all-weather road. However, common carriers such as Pacific Western Trucking, Grimshaw Trucking and Distribution and Hay River Truck Lines (all based in Edmonton) provide a vital service to settlements in the Valley. Common carrier operations account for over ninety per cent of the regular daily flow of commodities (excluding bulk petroleum products) to communities on the Mackenzie Valley highway network.[10] These carriers also provide the only scheduled, temperature-controlled, and less-than-truckload shipping services available in the region. In the past few years, the volume of freight handled by common carriers has risen significantly, despite the hardship of higher freight charges imposed on shippers.[11]

Figure 13

LOCATION OF MOTOR CARRIERS SURVEYED

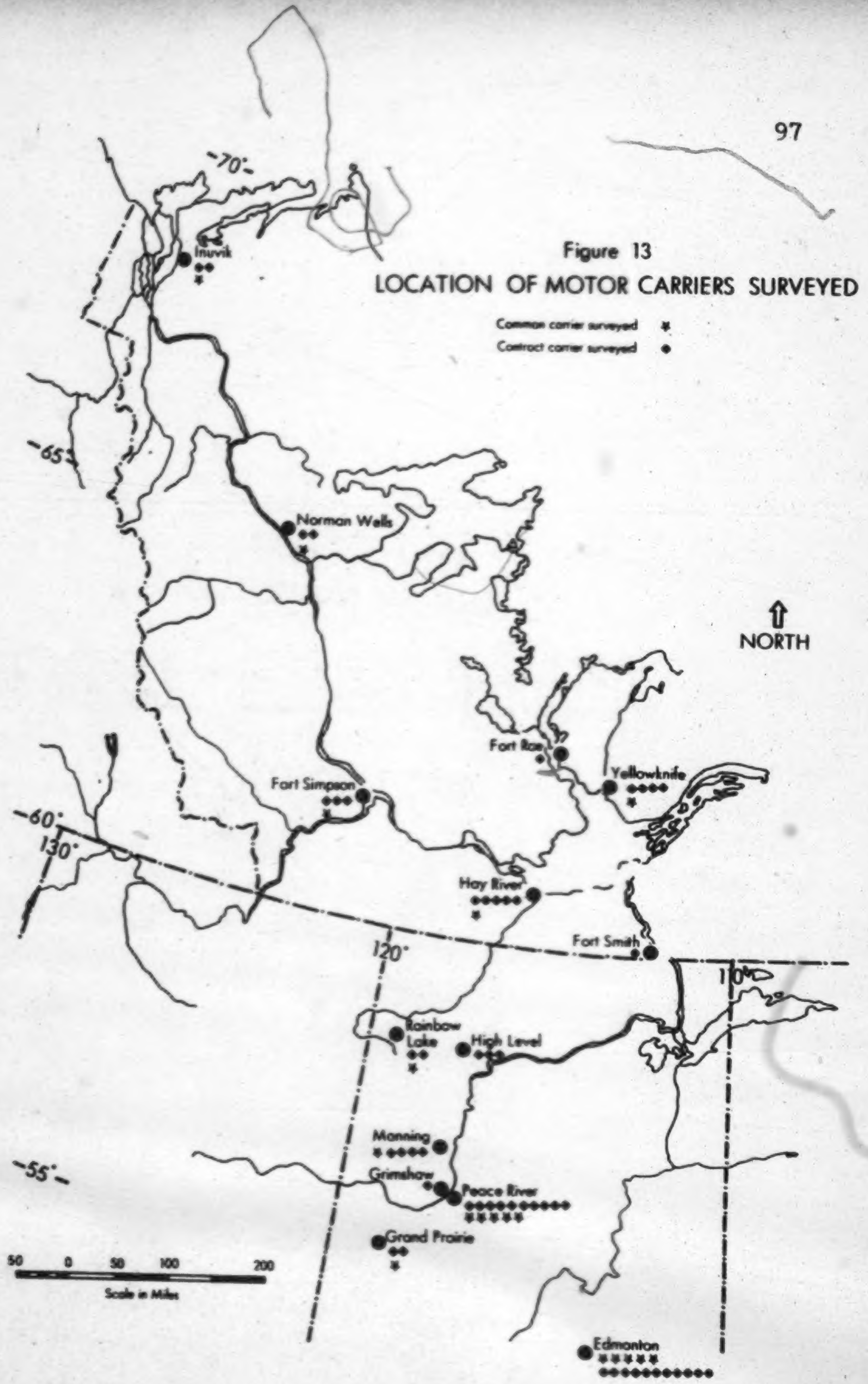

Common carrier surveyed *
Contract carrier surveyed ●
70°
65°
60°
55°
130°
120°
110°
Inuvik
Norman Wells
Fort Rae
Yellowknife
Fort Simpson
Hay River
Fort Smith
Rainbow Lake
High Level
Manning
Grimshaw
Peace River
Grand Prairie
Edmonton
NORTH
50 0 50 100 200
Scale in Miles

TABLE 5

COMMON AND CONTRACT CARRIER OPERATING AUTHORITIES IN THE MACKENZIE VALLEY--1972

Type of Carrier Service	Based in N.W.T. and Size of Carrier (no. of units)			Total Based in N.W.T.	Not Based in N.W.T. and Size of Carrier (no. of units)			Total Not Based in N.W.T.	Total all Carriers
	1	2-5	more than 6		1	2-5	more than 6		
Common	-	2	3	5	-	3	5	8	13
Contract:									
Heavy	-	4	2	6	-	15	11	26	32
Oilfield	-	1	3	4	-	11	10	21	25
Construction	34	20	9	63	17	12	4	33	96
Bulk petroleum	1	5	3	9	1	5	4	10	19
General	9	9	-	18	10	18	34	62	80
Moving-Cartage		3	-	3		8	18	26	29
Total	44	42	17	103	28	69	81	178	281
Private	8	10	2	20	-	2	1	3	23
Special:									
4a Hotshot	-	1	-	1	4	2	-	6	7
b Bus	-	7	-	7	-	-	2	2	9
c Delivery	5	13	-	18	-	-	1	1	19
d Auto Carrier	-	5	1	6	1	3	2	6	12
e Towing	1	2	-	3	4	10	7	21	24
Total	6	28	1	35	9	15	12	36	71
Total all carriers	57	81	23	161	37	91	99	227	388

Sources: Pers. communication, F. Murphy, Chairman, Highway Transport Board, Government of the Northwest Territories, Yellowknife, July 1973.

Material on file with the Highway Transport Board, Yellowknife.

Contract Carriers

Although only a small percentage of the total freight volume handled in northern settlements is carried by contract carriers, the contribution of contract operators to the overall distribution of goods in the Mackenzie Valley is significant. Contract carriers are especially important to the resource exploration and development sectors of the northern economy, where special services and unconventional equipment may be required. However, with the exception of contract operators catering to local road construction and earth-moving activities, most authorized contract carriers in the region are based in central and southern Alberta,[12] where supplemental contracts for idle equipment are more easily obtained (Table 6).

Of the contract carriers based in the Mackenzie Valley, very few operate solely as motor carriers. Most firms, such as Svend Lund (Yellowknife), Johnston-Lakeshore (Hay River), and Hanvold Expediting (Inuvik) provide heavy-hauling services, or off-highway transport equipment to specific industries as a complementary function to other basic services (e.g., contract drilling, road construction, seismic work, or expediting). In many cases, the relative importance of the contract carrier operations to these firms varies seasonally. For example, because of the physi-

TABLE 6

BASE OF OPERATIONS OF NORTHERN CONTRACT CARRIERS--1973

Type of Carrier	Base of Operations					Total
	N.W.T.	Alta.	B.C.	Other Can.	U.S.	
Heavy hauler	6	18	3	3	2	32
Oilfield hauler	4	20	1	-	-	25
Construction	63	32	-	1	-	96
Bulk petroleum	9	8	-	2	-	19
General Moving--Cartage	3	5	2	15	4	29
Total	103	128	10	29	11	281

Source: Pers. communication, F. Murphy, Chairman, Highway Transport Board, Government of the Northwest Territories, Yellowknife, July 1973, and Gordon R. Carter, Registrar of Vehicles, Government of the Northwest Territories, Yellowknife, 22 November, 1973.

cal limitations of off-highway ground movement by conventional equipment during the summer months, many drilling and seismic contractors rely on highway contracts during the slack summer months. For a number of years, one Yellowknife construction operator has converted gravel dump units in the winter months to provide winter road hauling services in the Mackenzie District and to keep capital equipment in service.[13]

An accurate estimation of the total volume of traffic carried by contract carriers in the Mackenzie Valley would be very difficult to obtain, and the validity of any estimate would be highly suspect. A significant proportion of contract shipments terminate at points off the Mackenzie highway network,[14] at remote mine centres, exploration, or power generation sites.[15]

Private Carriers

The operations of private carriers (commercial vehicles) have not been considered in this study since private carriers play a very limited role in the regional distribution of goods. Commercial vehicle operations are mainly confined to local pick-up and delivery functions within the settlements (e.g., local fuel-oil and propane distribution, trade vehicles, and automotive service vehicles). For most northern companies, private carrier service will remain uneconomical and impractical considering the high cost of northern operation, and the poor quality of northern roads. Even for some of the largest shippers in the Valley, contract or common carrier services are economical compared with private carrier operation (e.g., Giant Yellowknife Mines Ltd.). Taff points out that since;

> *...for-hire carriers serve more than one shipper, they have an inherent flexibility that private carriage does not possess. For-hire carriers have succeeded when they have provided better service than he can provide for himself at a rate which does not encourage private operation.*[16]

In Southern Canada and the United States, the entry of large volume private carriers has worked to keep freight rates down.[17] There are indications in the Canadian North that the quality of service rather than freight rate levels has been a major determinant in the choice between private operation and the use of public carriers. For example, the emphasis on reliable service has been a critical factor in the development of private carrier operations by northern food retailers (e.g., Northwest Transport and Horne and Pitfield Foods). The initial success of these firms in providing their own trucking services[18] on an economic basis,[19] may encourage other large volume shippers in the North.

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Carrier Regulation

Operating regulations for commercial and public service carriers are contained in the Public Service Vehicles Act for each province and territory in Canada. Vehicle dimensions, weights, axle loadings, and minimum safety and service requirements are established in the Acts. The authority to change or amend existing regulations remains with the provincial or territorial authorities (usually, the Highway Traffic Board). In the United States federal agencies, acting through the Interstate Commerce Commission, maintain authority over transportation legislation and carrier regulation, which has resulted in more uniform regulation and tighter control in the American motor carrier industry than in Canada. Motor carrier regulations for public operators in Alberta and the Northwest Territories are summarized in Appendix C.

Motor carrier regulation usually attempts to exert some control on permissable freight charges, and to control the indiscriminate entry of carriers to the market. In the Northwest Territories, all carriers must file the rates charged for specific services with the Highway Traffic Board, but neither Alberta nor the Northwest Territories traffic boards prescribe rates which may be charged by motor carriers in their jurisdiction. As well, the PSV Acts in Alberta and the Territories stipulate that all carriers must maintain public liability and personal property damage coverage, and cargo insurance.[20]

Most Alberta carriers belong to the Alberta Motor Transport Association (AMTA), which helps to establish uniform standards of service in the industry. There is no equivalent to the AMTA in the Territories, and also no positive control on the free-entry of competing motor carriers. The AMTA is lobbying to achieve "... effective control of entry into the trucking industry"[21] in Alberta, since it is felt that unrestricted entry leads to rate-cutting, unprofitable servicing, and reduction of industry standards by carriers in an effort to maintain trade territories. Experts in the transportation industry concur that;

> *The checks and balances provided by the normal marketing processes are not always present to the degree necessary to provide adequate control.*[22]

Operations managers interviewed expressed anxiety about the "laissez-faire" policy adopted in the Northwest Territories towards the issuance of public service operating authorities. They felt that continuation of this policy will ultimately lead to a further reduction of the quality of service in an effort to remain competitive, and the elimination of some important carriers in the North.

New federal labour regulations which govern extra-provincial carriers have also had a detrimental influence upon the ability of northern motor carriers to provide reliable and competitive service.[23] For example, the sixty-hour work week now imposed on highway truck drivers, as a safety measure, will contribute to northern operating expenses (driver accommodation and allowances), and necessitate more complicated, less efficient scheduling.

5 SPECIFIC DETAILS

Equipment

The quality and style of motor carrier equipment used in the Mackenzie Valley is diverse, and reflects the multiplicity of operating conditions and customer needs that are served. In general, standard highway equipment is utilized on the all-weather routes throughout the region (Plates 5 and 6). Some modifications are made to compensate for poor road conditions and gravel surface operation (e.g., rock guards, reinforced fuel tanks, shielded air lines, and rock deflectors), but otherwise, few special considerations are necessary in the selection of equipment for northern highway services. Heavier units, especially Kenworth, Hayes, and White tandem tractors seem to be preferred and provide longer service. Almost without exception, diesel units are chosen over gasoline engines for a number of reasons. Diesel fuel is considerably cheaper

Plate 5. Motor carrier highway equipment. The unit shown above is typical of the type of carrier equipment used by common and contract carriers on the Mackenzie Highway. The pre-cast concrete sections on the trailer were being delivered from Edmonton to the site of Pacific Western Airlines Hotel in Yellowknife during July 1973.

Plate 6. Motor carrier highway equipment. This plate shows a typical low-bed unit used on northern highway and off-highway operations to carry heavy equipment. The "Yukon" flex-trac vehicle on the low-bed was delivered to the Inuvik airport by a Hercules cargo aircraft (Plate 8).

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in all areas of the Mackenzie Valley, and diesel power is more efficient and reliable for long-haul service relative to gasoline.[24] Diesel fuel is available in all communities in the Northwest Territories connected by road. Parts and service depots for standard diesel engines are located in Hay River, Yellowknife, and Inuvik.

The largest northern common carrier firms lease some equipment from smaller independent operators based in the Northwest Territories and Northern Alberta. Equipment leasing increases the flexibility of individual carrier firms to accommodate new demands for service without long-term capital commitments, and also to adjust to short-term changes in the nature of commodity traffic. For the immediate future, owing to uncertain long-term demand, equipment leasing will continue to provide a measure of security to northern common carrier operations.

One of the most serious handicaps to motor carrier operation in the Mackenzie Valley is the 72,000 pound vehicle load limit enforced on Northern Alberta and Territorial roads. Individual vehicle payloads have been increasing in the motor carrier industry during the past decade, in an effort to increase the profit per ton-mile of service.[25] Load limitations, necessary where existing roads are inadequate to accommodate modern equipment, cause seasonal variations in the quality of service, and contribute to high freight charges in the North. Load limitations are so significant in increasing northern operating costs (and, therefore, freight charges), that Guy Mauzeroll, after an extensive federal study, recently concluded;

> *...increasing the load limits on Territorial roads might, for practical purposes, eliminate the cost differential between the north and south.*[26]

Certainly, an increase in northern road limits would permit carriers greater freedom in their selection of equipment, and possibly improved customer service. For example, multiple combination units[27] have been used with only limited success in the Mackenzie Valley, and are restricted to special permit operation in most areas.[28]

Equipment leasing or rental is much less common amongst contract carriers, since most contract equipment is suited to a limited range of carrier services, and is often custom-built for specific customer needs. Trailer leasing is common in the contract carrier industry, especially on winter road and other off-highway services, since a single carrier cannot always meet the trailer requirements peculiar to each customer. The significance of trailer leasing in northern communities, where off-highway services are important, is demonstrated by the tractor-trailer ratios computed for each settlement in Table 7.

TABLE 7

TRUCK-TRACTOR AND TRUCK-TRAILER REGISTRATIONS IN THE NORTHWEST TERRITORIES--1973

Place of Registration	Truck-Tractors (A)	Truck-Trailers (B)	Tractor-Trailer Ratio (A)/(B)
Aklavik	7	1	7.00
Enterprise	318	219	1.45
Fort Good Hope	2	2	1.00
Fort McPherson	2	-	
Fort Norman	5	-	
Fort Resolution	5	1	5.00
Fort Simpson	75	12	6.25
Fort Smith	29	36	0.81
Hay River	200	268	0.75
Inuvik	139	43	3.23
Norman Wells	15	5	3.00
Pine Point	13	7	1.86
Tuktoyaktuk	2	-	2.50
Yellowknife	258	139	1.86
Total	1070	733	
Territorial average ratio			3.25

Source: Pers. communication, Gordon R. Carter, Registrar of Vehicles, Government of the Northwest Territories, Yellowknife, 22 November 1973.

Many trailers used on off-highway service are not registered in the Territories and travel on trip permits, which explains the overall tractor-trailer ratio of 3.25 in the Northwest Territories. In Hay River, Yellowknife, Pine Point, and Fort Smith, where scheduled contract and common carrier services are most important, the tractor-trailer ratios are closer to unity. The low value, 0.745, for Hay River, reflects the transportation orientation of this community, and its position as the major land-water transshipment point in the Mackenzie Valley.[29]

Line-haul Operating Costs

Common and contract carrier firms were asked to provide information on average line-haul operating costs for tractor-trailer equipment over the Mackenzie Valley highway system. The wide disparity in responses indicates that many operators, especially small contract carriers,[30] have a very poor understanding of their direct line-haul operating costs. Wages and fuel accounted for over fifty per cent of direct line-haul costs in 1972. It is likely that new developments and shortages in the energy business, coupled with more stringent labour demands in the trucking industry, will result in an increased allocation of expenses in these two areas[31] (Table 8).

The line-haul operating expenses compare with

TABLE 8

TYPICAL LINE-HAUL OPERATING COSTS FOR NORTHERN MOTOR CARRIERS[a]--1973

Nature of Expenses	Cost per Vehicle mile (cents)[b]	Proportion of Total Costs (%)
Drivers' wages	26.5	30.9
Drivers' allowances	1.1	1.3
Fuel and oil	20.9	24.3
Insurance	4.2	4.9
Equipment maintenance	14.4	16.8
Tires and tubes	4.7	5.5
Licenses	2.2	2.5
Depreciation	7.5	8.7
Miscellaneous	4.4	5.1
Total	85.9	100.0

Sources and Notes: [a] Based on interview and questionnaire responses from four major common carrier and twenty-one contract carrier (nine companies with more than six units) firms which operate in the Mackenzie Valley.

[b] Considering a 40,000 lb. northbound payload, less than 20% backhaul payload, and no special carrier services (e.g., heated or refrigerated service--averages about 10% higher).

similar calculations made by Maxwell,[32] Mauzeroll,[33] and Trimac Consulting[34] (Table 10). It should be noted that operating costs reported by contract carriers tended to be significantly higher than the average shown in Table 9. For example, local gravel truck operators and construction industry contract carriers reported line-haul operating expenses which averaged about 94.0 cents per vehicle mile. The allocations of expenses to tires and maintenance were about three per cent higher for these carriers. There were no allocations for driver allowances, since most of these carriers are community-based.

Two major private carriers in the food retailing industry reported line-haul operating costs as low as 56.0 to 60.0 cents per vehicle mile for refrigerated service.[35] Whether this information reflects an accurate analysis of line-haul expenses for these private carriers cannot be determined. It is known that in communities served by these private carrier services, food retailers enjoy hundredweight freight rates from five to 42 cents below typical rates available from common or contract carrier.[36]

Higher fuel and labour costs, poor road conditions, load restrictions, and uncertain demand contribute to the high cost of northern trucking. Another factor, the lack of sufficient backhaul traffic, almost doubles line-haul operating costs for northern carriers and results in high

TABLE 9

NORTHERN LINE-HAUL OPERATING COSTS[a] RELATED TO LINE-HAUL OPERATING COSTS IN SOUTHERN CANADA--1973

Type of Carrier Operation	Location	Line-Haul Operating Costs (cents)	Ton-Mile Operating Costs (cents)
Paved highway	Southern Canada	65.9[b]	6.6[f]
Gravel highway	Southern Canada	72.0[c]	7.2[f]
Gravel highway	Northern Canada	85.9[d]	8.6[f]
Off-highway	Northern Canada	220.0[e]	220.0[g]

Sources and Notes:

[a] Considering a 20-ton payload in both directions, unless otherwise specified,

[b] Estimated for 1973, Trimac Consulting Services (Calgary),

[c] After G. Mauzeroll, "Etude comparative des couts de transport dans le Nord, Au Nord du 60° (Ottawa: DIAND, 1972), passism,

[d] Based on information collected during field work in July and August, 1973,

[e] David R. Podmore, "Winter Road Operations," North/Nord (Ottawa: DIAND, 1973), vol. XX, no. 6, pp. 16-19.

[f] no backhaul,

[g] Winter-road operation with a 100% backhaul.

TABLE 10

DISTRIBUTION OF LINE-HAUL OPERATING COSTS[a] IN NORTHERN CANADA--1973

Type of Expenditure	Distribution of Costs in Northern Canada (%)	Distribution of Costs in Southern Canada (%)	Difference
Wages (including allowances)	32.2	39.4	-7.2
Fuel and Oil	24.3	16.6	+7.7
Insurance	4.9	4.0	+0.9
Equipment maintenance (including tires and tubes)	22.3	19.6	+2.7
Licenses	2.5	4.5	-2.0
Depreciation	8.7	13.4	-4.7
Other	5.1	2.5	+2.6
Total	100.0	100.0	

Sources and Notes:

[a] Considering a 20-ton payload in both directions unless otherwise specified,

[b] Pers. communication, S. Mozes, Head, Motor Carrier Statistics, Transportation and Communications Division, Statistics Canada, Ottawa, 7 September 1973.

freight rates since shippers must help compensate for the return of empty units.

Eighty per cent of the common and contract carriers interviewed, reported that ninety-five per cent of their southbound units are normally empty or contain only partial loads.[37] Over ninety per cent of the carriers surveyed indicated that less than twenty per cent of northbound units carry partial loads. Contract carriers reported more southbound full payload traffic and a higher proportion of truckload northbound units than common carriers, which indicates contract carriers are moderately more successful in reducing high line-haul expenses resulting from limited backhaul traffic in the North.

Northern operation imposes unique strains on motor carrier equipment. The nature of common equipment failures and problems are often related to gravel road operation. Tire failure, damage, and wear were cited by northern operators as the most prevalent problems. Most in-service equipment damage is attributable to flying gravel, dust (summer months), and excessive vibration or twisting due to poor road conditions. Damage to suspensions (broken spring leafs), tractor and trailer undercarriages, transmission, rear-end, engine, and radiator housings occur frequently, and are the most serious, since these usually result in costly delays. In the winter, especially on off-highway service, metal fatigue due to cold weather embrittlement, frozen brake and fuel lines, and the problems of cold weather equipment servicing are significant.

Table 9 compares typical line-haul operating costs for carriers in southern Canada, and highway and winter-road operations in the Mackenzie Valley. Table 10 emphasizes the disproportionate allocation of vehicle operating costs in northern Canada for fuel and oil, maintenance, tires and insurance. Additional expenses for custom heater equipment, rock shielding, chains, tarps, and communications account for the higher proportion of costs listed as "other."

Carrier Terminals

Little research has been done in Canada regarding the location and operation of motor carrier terminals. Urban and transport planners have become more interested in the subject as the pressures mount to limit trucking operations within Canadian cities. Northern Canadian trucking operations have expanded so rapidly, and serve such a small and geographically dispersed market that any deliberate consideration of terminal location, design, or operation by northern motor carriers has been seriously neglected.

The majority of northern motor carrier terminals are carrier-owned and operated. There are only a few exceptions of cooperative terminal operation between carriers. All major common carriers maintain private company terminals in each community served (Table 11). This practice, which developed because of the highly competitive situation in the northern trucking industry, has led to a considerable duplication of services, personnel, and facilities, and has accentuated the development of distinct territorial divisions between major carriers.

Terminal requirements are dependent upon the volume and nature of traffic handled, the size of the community served, and customer demands for special handling, storage, or forwarding services.[38] At the present time, most northern terminals seem to be inadequate for existing freight volumes. This may be due to the comparatively recent development of the northern trucking industry, and uncertainty regarding future trends.

There is no uniform pattern of terminal location in northern communities, and little coordination between air, water, and land transport freight-handling services. This will be especially disadvantageous in the future, since ground transport and air or water container-shipping services are gradually evolving as complementary functions in several centres (e.g., Hay River, Inuvik, and Yellowknife).

Common carrier terminals examined in Yellowknife and Hay River require greatly improved handling systems to reduce delays and damage to customer shipments during the local distribution process. The situation is especially chronic in Yellowknife, where over seventy per cent of the common carrier clients interviewed indicated they were displeased with the quality of service. Many clients reported that shipments frequently remain in terminals four or five days before final delivery, and also that "part-lot" forwarding is a common annoyance.

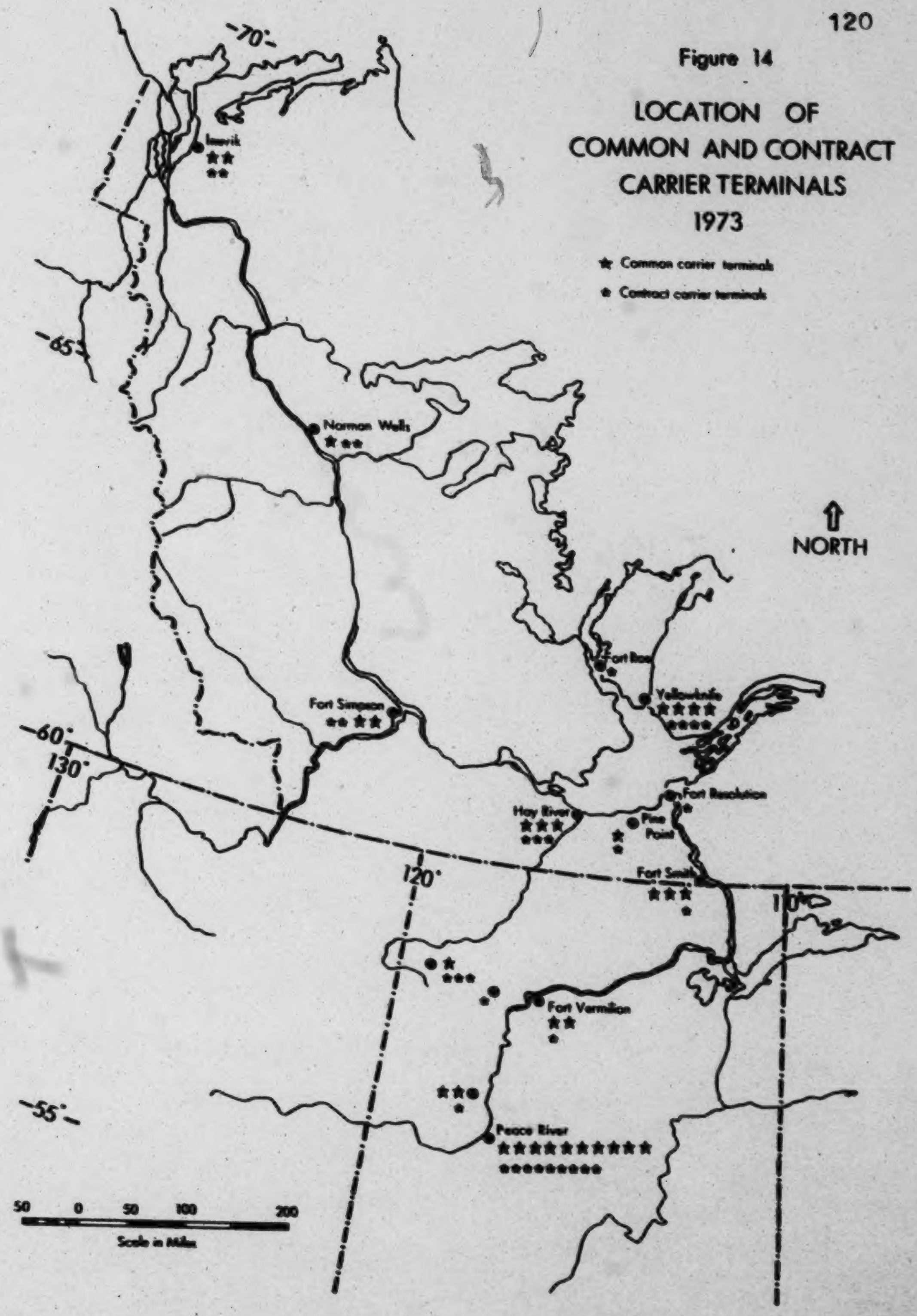
Almost every common carrier client interviewed reported that damage, breakage, and loss due to pilferage, exceeds three per cent of the total volume of shipments received.[39] One automotive hardware wholesaler in Yellowknife reported that he has to file claims on at least five per cent of all shipments received annually. New systems, improved facilities, and more competent personnel in the local terminals would help to reduce damage due to mis-handling, improve service, and cut the incidence of claims procedures[40] (Figure 14).

Rates and Revenues

Northern motor carrier operators have been under considerable pressure to justify the rapid inflation of freight rates over the past five years. Forty per cent of

Figure 14

LOCATION OF COMMON AND CONTRACT CARRIER TERMINALS 1973


★ Common carrier terminals
★ Contract carrier terminals
70°
65°
60°
55°
130°
120°
110°
Inuvik
Norman Wells
Fort Simpson
Fort Rae
Yellowknife
Hay River
Pine Point
Fort Resolution
Fort Smith
Fort Vermilion
Peace River
NORTH
50 0 50 100 200
Scale in Miles

northern trucking clients interviewed in this survey indicated that they were unhappy with the northern common carrier services available to them. Over 55 per cent claimed the rates they were forced to pay were unreasonable. Only a very few clients of contract carrier services were unhappy with their rates, but this is understandable since contract rates are negotiated and determined by mutual agreement. Also, contract carrier rates are usually based on trailer-load shipments and tend to be significantly lower per hundredweight than common carrier volume or class rates.[41]

Northern common carrier rates on less-than-truckload shipments increased approximately 35 per cent between 1968 and 1973, while truck-load rates increased only about ten per cent.[42] If the rate of increase in line-haul operating costs experienced by carriers is considered, it appears that northern truck clients are unjustified in their claims that the rate of inflation of northern freight rates has been unreasonable. During the same period (1968-1973), wage rates and fuel costs rose over 28 and 30 per cent,[43] respectively. As well, the proportion of less-than-truckload traffic, which is relatively more expensive to handle, has increased in recent years.[44]

There is not sufficient space in this study to examine the relative merits and disadvantages of various methods of freight classification and rate determination. It should be pointed out that most common carrier freight moves under class and volume rates.[45] There are very few examples of commodity rates[46] in the Mackenzie Valley. However, several common carriers do negotiate agreed rates on an annual basis with major customers.[47]

A joint federal-provincial and territorial committee should be established to examine existing rate-scales utilized in the Canadian trucking industry, since the present system, based on rail-rate structures is unrealistic, especially in the northern situation. A new rate-determining system, based on a consideration of the actual costs related to the size, nature, and volume of commodities shipped would help to alleviate friction which exists between clients and carriers.

There has been much criticism of the policy of imposing minimum rates[48] throughout the Mackenzie Valley (Table 11). Such criticism is generally unwarranted and reflects an unrealistic demand from the transport-utilizing sector to burden motor carrier operations with uneconomic less-than-truckload shipments. Taff concludes that "... establishment of minimum rates may be the only method for securing stability of rates in competitive areas."[49] While the imposition of minimum rates has come rather recently in the North, and at first examination, may appear to re-

TABLE 11

LOCATION AND NUMBER OF MOTOR CARRIER OPERATIONS AND TERMINALS BASED IN THE MACKENZIE VALLEY--1973

Location	Number of Operations[a]			Number of Terminals[b]		
	Common Carriers	Contract Carriers	Total	Common Carriers	Contract Carriers	Total
Peace River	5	10	15	10	9	19
Grande Prairie	1	2	3	1	2	1
Manning	1	4	5	2	1	3
High Level	-	1	1	-	-	-
Rainbow Lake[c]	1	2	3	1	3	4
Fort Vermilion[d]	1	3	4	2	1	3
Enterprise	-	-	-	-	1	1
Hay River	1	5	6	3	3	6
Pine Point	-	1	1	1	1	2
Fort Resolution	-	1	1	-	1	1
Fort Smith	-	1	1	3	1	4
Fort Providence	-	-	-	-	-	-
Fort Rae	-	1	1	-	1	1
Yellowknife	1	4	5	4	4	8
Fort Simpson	1	3	4	2	3	5
Norman Wells	1	2	3	1	2	3
Inuvik	1	-	1	2	2	4
Total	14	40	54	32	36	65

Sources and Notes:

[a] Only motor carriers who maintain a "base of operations" (i.e., a service agent and office) are included.

[b] A "terminal" must provide loading, unloading, and shipment storage facilities.

[c] Includes Zama Lake.

[d] Includes La Crete.

[e] Not all contract carriers maintain terminal facilities.

Based on field survey, July-August 1973 and, pers. interview, John Attrill, Service Agent, Alberta Motor Transport Association, Edmonton, September 1973.

strict the usefulness and serviceability of northern motor carrier transportation for the small shipper, minimum rates ultimately protect the customer as much as the carrier within a tariff area. Rate-cutting and uncompensatory competitive strategies ultimately interrupt the reliable service being provided, and lead to a long period of re-adjustment at higher than reasonable rate levels and limited competition.[50]

An examination of "operating ratios" for major common and contract carriers in the Mackenzie Valley would provide the most reliable basis for assessing the legitimacy of existing northern freight charges. Unfortunately, very little current information is available for the Canadian trucking industry as a basis for comparison. The average operating ratio for the largest common carriers in the Mackenzie Valley was estimated to be about 94.0 in 1972.[51] The average ratio for contract carriers was generally less favourable (96.0 to 98.0).

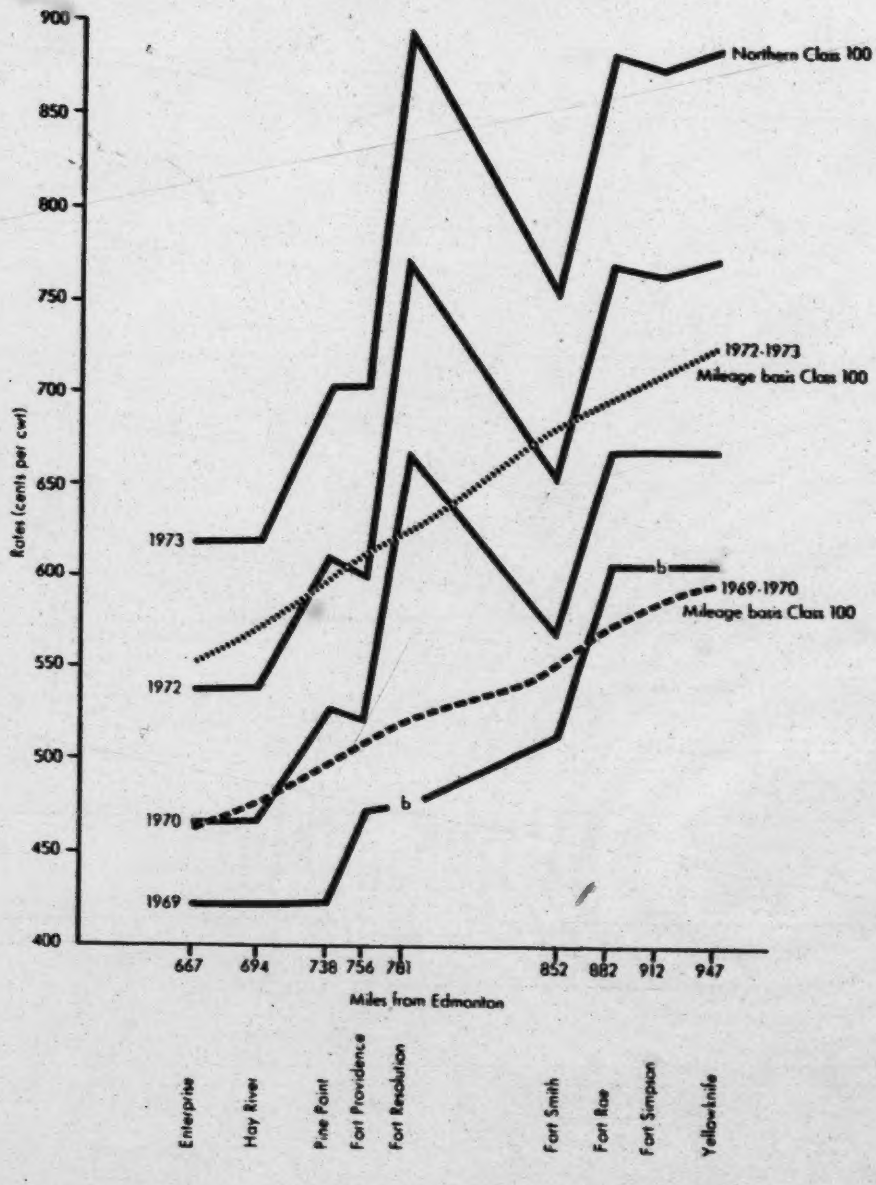
Operating ratios which average one to 1.7 per cent less[52] than those for southern carriers do not seem exorbitant, considering the disadvantages and problems of northern service. Northern motor carriers have higher line-haul, labour, and staff maintenance costs than their southern counterparts. Northern operators also have considerable difficulty attracting and keeping qualified personnel in the small northern communities. These factors, in association with large seasonal variations in demand, tend to keep expenses up and revenues down. Also, there have been indications, especially amongst contract carriers that, since the initial boom of oil exploration and related northern activity has passed, the revenue position of major northern carriers is gradually approaching levels typical in the South.[53] On this basis, carriers and legislators should be careful not to overreact by adjusting rate structures when earning conditions fluctuate over short-terms. Purdy advises the:

> *Primary responsibility in this area should rest on private management. Business managers must develop mechanisms that will assure that proposals for rate changes do not merely reflect the isolated interest of the individual firm but some broader interest in the quality of competition.*[54]

The present northern freight rate structure seems to reflect local differences in traffic volume, road quality, backhaul cargo availability, and future market growth potential, as well as distance. In Figure 15, standard suggested mileage basis rates for class 100 freight are compared to the published class 100 freight rates[55] used in the Mackenzie Valley. Northern class 100 rates rise as the distance from Edmonton increases, but the extreme deviations from the more linear trend of standard mileage

Figure 15

NORTHERN CLASS 100 RATES COMPARED TO ALBERTA STANDARD MILEAGE BASIS CLASS 100 RATES 1969 - 1973[a]



Notes:

[a] 1971 omitted since mileage basis rates did not change 1970-1971, and Class 100 rates changed only slightly for certain runs

[b] no service in 1969

Source:

Alberta Motor Transport Association, Directory, 1973. 1972, 1971, 1970, 1969, passim.

basis rates reflect geographic variation in road quality, the volume of traffic, and the size and nature of communities served. For example, northern class 100 rates to Fort Resolution are disproportionately high[56] due to poor road conditions east of Pine Point and the limited potential of this small native community to generate truckload traffic or backhaul cargo. Rates to the larger government centre of Fort Smith tend to approach Alberta mileage basis rates and emphasize the significance of truckload and backhaul traffic[57] carried on the Fort Smith run, as well as superior road conditions.

Figure 15 also reveals that northern freight rates seem to have increased more rapidly than southern rate scales. Considering the general trend towards higher operating costs throughout the Canadian trucking industry, cost differentials between northern and southern operations, and the levelling-off of northern carrier operating ratios, any short-term change in the relationship between northern and southern rate scales seems unlikely.

CHAPTER 4

FOOTNOTES

[1] Barry Roberts, "Pipeline and Highway: A Massive Research Project," north/nord, vol. XX, no. 4 (July-August, 1973), p. 11.

[2] In the trucking industry "conventional" implies that the equipment used has not been customized or designed for special services or off-highway operation.

[3] The Northwest Territories "Public Service Vehicles Act" has been extensively amended and revised during the past five years. However, northern trucking operators have been the principle critics of the Act, calling for more rigid legislation consistent with operating regulations in neighboring provinces and the Yukon.

[4] The information on George Pinsky was obtained from an exhibit in the Yellowknife Museum, July, 1973.

[5] Many motor vehicles from the early construction projects, such as the Canol Pipeline and the DEW line, were abandoned in the Territories after project completion. The economics of backhauling such equipment, usually in poor condition after a few seasons northern service, are unfavourable.

[6] Northwest Territories, Public Service Vehicles Ordinance, Reg. 9.2.22 (1967), p. 40.

[7] Ibid.

[8] DBS, Motor Carriers-Freight, Cat. no. 53-222 (Ottawa: Information Canada, 1969), p. 6.

[9] *Ibid*.

[10] This is derived from data gathered during field work in July and August 1973, which is presented and discussed in the following chapter.

[11] Freight rates in most northern communities have risen about 20% between 1969 and 1973. Major common carriers handled approximately 30 per cent more traffic in 1973 than 1969. (Based on interviews with operation managers of northern common carrier services.) Freight rates and traffic volumes for motor carriers in the Prairies rose about 10% and 15% respectively during the same period.

[12] Some of the largest northern contract carrier companies are based outside the Northwest Territories. For example, Kap's Transport, Scandia, Pe Ben Trucking, and Keen Industries have head offices in Edmonton, Deines Brothers and Cross Arctic Transportation are based in Calgary.

[13] Pers. interview, R. Robinson, Manager, Robinson's Trucking Limited, Yellowknife, July 1973.

[14] Some examples would include Echo Bay Mines (Great Bear Lake), Terra Mining and Exploration (Camsell River), and the power generation plants on the Talston and Snare Rivers.

[15] Of the 271 motor carrier customers surveyed, 16.6% indicated they rely solely on contract carrier service. 39.1% of clients reported they use contract carriers, but on a limited basis.

[16] Charles Taff, *Commercial Motor Transportation* (Homewood, Illinois: Irwin, 1969), p. 159.

[17] After H. L. Purdy, Transport Competition and Public Policy in Canada (Vancouver: University of British Columbia, 1972) and Taff, *passim*.

[18] It may not be entirely correct to call these operations "private carrier" since "purchased transportation" is often very important in their systems. For example, Horne and Pitfield Foods (Edmonton) lease tractor equipment from Papp's Trucking (Peace River). Purdy points out that "purchasing transportation" helps to offset high terminal and equipment investment.

[19] Private carrier operating costs are discussed on page 113.

[20] Alberta, PSV Act, Reg. 3.6.7 (1972), p. 65, and Northwest Territories, PSV Ord., Reg. 13.18.1 (1967), p. 18.

[21] *Edmonton Journal*, 27 January 1973, p. 95.

[22] *Edmonton Journal*, 27 January 1973, p. 91.

[23] *Financial Post*, 10 November 1973, p. 6.

[24] Gasoline-powered trucks are used for local delivery and pick-up vehicles since the economy and efficiency of diesel power are not significant on short-haul interrupted service.

[25] Higher ton-mile revenues increase the ability of carriers to absorb increased operating costs and, therefore, help to keep freight rates low.

[26] Guy Mauzeroll, "Etude Comparative des couts de transport dans le Nord," *Au nord du 60°* (Ottawa: Affaires Indiennes et du Nord, 1972).

[27] "Multiple combination units" are called "double-bottoms" in the industry, and refer to tractor-trailer combinations comprised of a truck-tractor, semi- or full-trailer, followed by a second full-trailer. Depending on the manufacture, a double-trailer unit can mean a 20% increase* in payload (volume) over conventional tractor-semi-trailer units. (*27-foot Fruehauf Model F Doubles versus a standard 45 foot single semi-trailer.)

[28] Canadian Freightways has used double-trailer units over the Alaska Highway for several years, with marked success. Pacific Western Trucking and Hay River Truck Lines run doubles on occasion, over northern routes. As northern operating costs increase, road conditions improve, and traffic volume increases, the pressure to remove restrictive legislation will mount.

[29] The "turnabout" of empty trailers is highest in communities serviced by scheduled carriers, since there is usually a high demand for empty equipment at southern terminals. In a transportation centre such as Hay River, where trailers may be forwarded, or not unloaded immediately, many more trailers are required and registered locally.

[30] Less than six tractor units.

[31] Financial Post, 8 December 1973, p. 40.

[32] B. Maxwell, A Brief Outline of the Economics of Northern Trucking Operations (Ottawa: DIAND, 1971).

[33] Mauzeroll, "Etudes comparative des couts de transport dans le Nord," Au Nord du 60° (Ottawa: Affaires Indiennes et du Nord, 1972).

[34] Trimac Consulting Services, Mackenzie Pipeline Transportation Support Study (Calgary: Trimac Consulting, 1971).

[35] Common and contract carriers usually charge an additional 15% temperature-controlled service (AMTA Directory 1973).

[36] Two food retailers in Yellowknife had preferential rate agreements of $2.65 and $3.08 per cwt. in 1972. Rates offered by common carriers at that time on the equivalent volume of traffic (not considering refrigeration charges) would have averaged $2.70 and $3.50 per cwt. respectively.

[37] Over 50% of southbound trailers contained less than 25% capacity payloads.

[38] Most contract carriers maintain only very small terminal facilities for equipment servicing, maintenance, communication and clerical services, since most contract shipments are delivered to the consignee's door. Storage and break-of-bulk services by contract carriers are minimal.

[39] Compared to less than 10% overall in the Canadian trucking industry. Calculation based on statistical material provided by N. Zayachowski, Department Statistician, DIAND, Ottawa, August 1973.

[40] Settlement of a $1,000 claim can obviate the profit on $20,000 worth of revenue freight (i.e., if operating ratio is about 0.95). Claims procedures are generally more expensive in the North, in part, due to communications disadvantages. The significance of higher insurance charges and claims are reflected in the higher proportion of line-haul costs allocated to insurance in Table 4.

[41] Contract carrier line-haul operating expenses averaged about 8.1 cents per mile more than common carriers surveyed, but contract carriers typically carry truckload traffic on a point-to-point basis, and have smaller terminal (fixed) costs. Contract carriers also have an inherent flexibility to adjust to changing traffic demands.

[42] Calculations based on statistics from: Alberta Motor Transport Directory (Calgary: AMTA, 1968-1973 inclusive), *passim*.

[43] Based on calculations and data obtained in the Canadian Statistical Review (Ottawa: Information Canada), *passim*.

[44] There are no figures available comparing the proportion of LTL to TL traffic on northern operations before 1972, but the operations managers of the major common carrier companies consulted concurred with this statement.

[45] Class and volume rates are explained in Appendix D.

[46] Commodity rates are offered under special circumstances to large volume bulk shippers. In the Mackenzie Valley, bulk petroleum, bulk cement, and some chemicals (mining reagents) move under special commodity rates which have been negotiated with contract carriers and are unpublished.

[47] For example, the Hudson's Bay Company calls for bids from northern carriers each year and selects the carrier offering the most competitive agreed-rate bid based on a guaranteed minimum volume of traffic. The rates are not disclosed.

[48] Minimum rate scales now exist for truck shipments to all northern communities. The minimum rate is usually the Class 100 rate, and is designed to reduce the number of small shipments handled by encouraging small shippers to use other, more competitive modes (e.g., postal system or bus).

[49] Taff, *op*. *cit*., p. 362.

[50] After Taff, and Purdy, Ibid.

[51] Based on data obtained in interviews with personnel at Hay River Truck Lines, Northwest Transport, Grimshaw Trucking and, The Annual Report, Pracific Western Airlines (Vancouver: PWA, 1972).

[52] Based on transport data provided by Mr. Doug Rankin, Road Transportation Unit, Transportation and Public Utilities Division, Statistics Canada, Ottawa, June 1973.

[53] Financial Post, 22 September 1973, p. 17.

[54] Purdy, op. cit., p. 113.

[55] Obtained from Alberta Motor Transport Directory (Calgary: AMTA, 1968 - 1973 inclusive), passim.

[56] That is, compared to the average difference between class and mileage-basis rates.

[57] Fort Smith is the base for many territorial and federal government offices. It is also the centre for the northern supply branch of the National Parks of Canada. Timber cutting and lumber production are also becoming important in the Fort Smith area.

CHAPTER 5

NORTHERN MOTOR CARRIER FREIGHT MOVEMENTS

> *The physical aspects of the flow of individual commodities and groups of commodities are of great significance.*
>
> *Commodity flow studies have an obvious descriptive value. Just as regional data on industrial production, income, employment, and population provide useful information on the levels at which a regional economy is operating, point-to-point data on internal, as well as external movements of commodities provide useful information of the strategic connections of a region.*[1]

The identification and measurement of northern motor carrier traffic flows is a relatively difficult task, owing in part to the poor quality of existing records for motor carrier transport services in the area. McCarty[2] advises that physical movements[3] of traffic flow are not as valuable in transportation studies since "... they lack universality in that they afford no basis for comparing one type of transportation service with another or with other sectors of an economy."[4] Isard,[5] McCarty, Norton,[6] and several regional economists suggest that income measures[7] of traffic flows are more useful and provide more accurate approximations of transport utilization. Income measures of transportation service require data which are not always available from all carriers in a particular area -- namely, revenue accounts for all operators, and a knowledge of the operating ratio for individual carriers.

Detailed information of the type required for an income measure of transportation service is available from only a few carriers in the Mackenzie Valley. Only a limited number of operators were willing (or able) to supply physical measurement data of the traffic volumes handled. Under these circumstances, physical measurement data provided by motor carrier clients, represented the only reliable method of accurately determining traffic flows in the study area.

Response to Northern Trucking Client Survey

The use of physical measurement data provided by motor carrier clients does not represent as great a disadvantage as would normally be imagined. First, the number of clients to be surveyed in the sixteen communities and mine centres[8] accessible by motor transport was relatively small so that partial samples were not necessary. Second, the rate of return for questionnaires was encouraging (51.3%). Over half of the client surveyed who declined to complete the questionnaire (48.7% declined to return a completed questionnaire) supplied all of the essential information when interviewed (28.4% of all the data used was obtained in interviews[9]).

Traffic volumes for 20.3 per cent of all the clients included in the survey had to be estimated. However, since about ninety per cent of these clients were typically very small shippers and receivers[10] of freight by motor carrier, the problems of estimation were not really significant. In most cases, some approximation of the traffic volume handled by these clients was obtained in conversation with local freight agents, and checked by comparison with the questionnaire responses of similar business functions in the same settlement or other communities. The number and nature of responses used to determine traffic flows[11] are given in Appendix E.

Types of Trucking Services

Over sixty per cent of all motor carrier freight shipments to communities and centres in the Mackenzie Valley in 1972, were handled by common carriers. Less than thirty-five per cent of the total freight traffic in the Valley was handled by contract carriers or independent operators (Table 12).

The role of transportation brokerage services in the Mackenzie Valley seems to be insignificant. Only six clients (2.1%) reported that they used or relied upon the

TABLE 12

TYPE OF TRUCKING SERVICE USED BY MAJOR CLIENTS[a] IN THE MACKENZIE VALLEY--1972

Freight Services Handled by	Type of Carrier	Percentage of Total Truck Traffic (By Volume)	Number of Respondents
Transportation broker	contract	2.1	6
Independent operator	contract	12.9	35
Supplier	common and private	22.5	61
Scheduled carrier	common	58.9	159
Other[b]	contract	3.7	10
Total		100.0	271

Sources and Notes:

[a] Identified from questionnaire and interview responses, July 1973.

[b] Includes off-highway, all-terrain, and winter road carriers.

services of a broker. It is important to note that of the clients who reported using brokers, four were hospitals (Fort Rae, Fort Smith, Hay River and Yellowknife), which depend on a variety of special transport services and numerous widely dispersed suppliers. Hospital shipments are typically small so that economics are affected when northbound shipments can be assembled and collectively discharged by the broker. The purchasing agent[12] at Stanton Yellowknife Hospital indicated that less delay and greater care in handling shipments result when brokerage services are utilized. Communication and expediting costs are also minimized.

Off-highway and winter-road contract services are confined to major mineral exploration or extraction operations, and hydro-electric installations at Snare Falls and on the Talston and Yellowknife Rivers (Figure 2). The demand for winter-road services varies from year-to-year, dependent upon a variety of exogenous factors especially the demand and price of minerals on world markets. In 1972, 3.7 per cent of the clients surveyed depended upon winter road and related special off-highway services. The importance of special trucking services for each business function is shown in Table 13.

Utilization and demand for each type of trucking service varies according to business function and location.

TABLE 13

PROPORTION OF TRUCKING SERVICES HANDLED BY SPECIAL CARRIERS[a] FOR EACH BUSINESS FUNCTION--1972

Business Function	Proportion of total Services Handled by Special Carriers (%)
General retail	7.3
Food retail	-
Wholesale Merchant	-
Construction industries	8.7
Accommodation	3.2
Hospital/health	-
Transp./commun./utilities	3.3
Automotive	-
Mineral production	20.0
Mineral exploration	31.5
Government	9.0
Aviation industry	-
Bulk petroleum	3.0
Other	20.0
Total	100.0

Notes: [a] Includes off-highway, all-terrain and winter-road carriers.

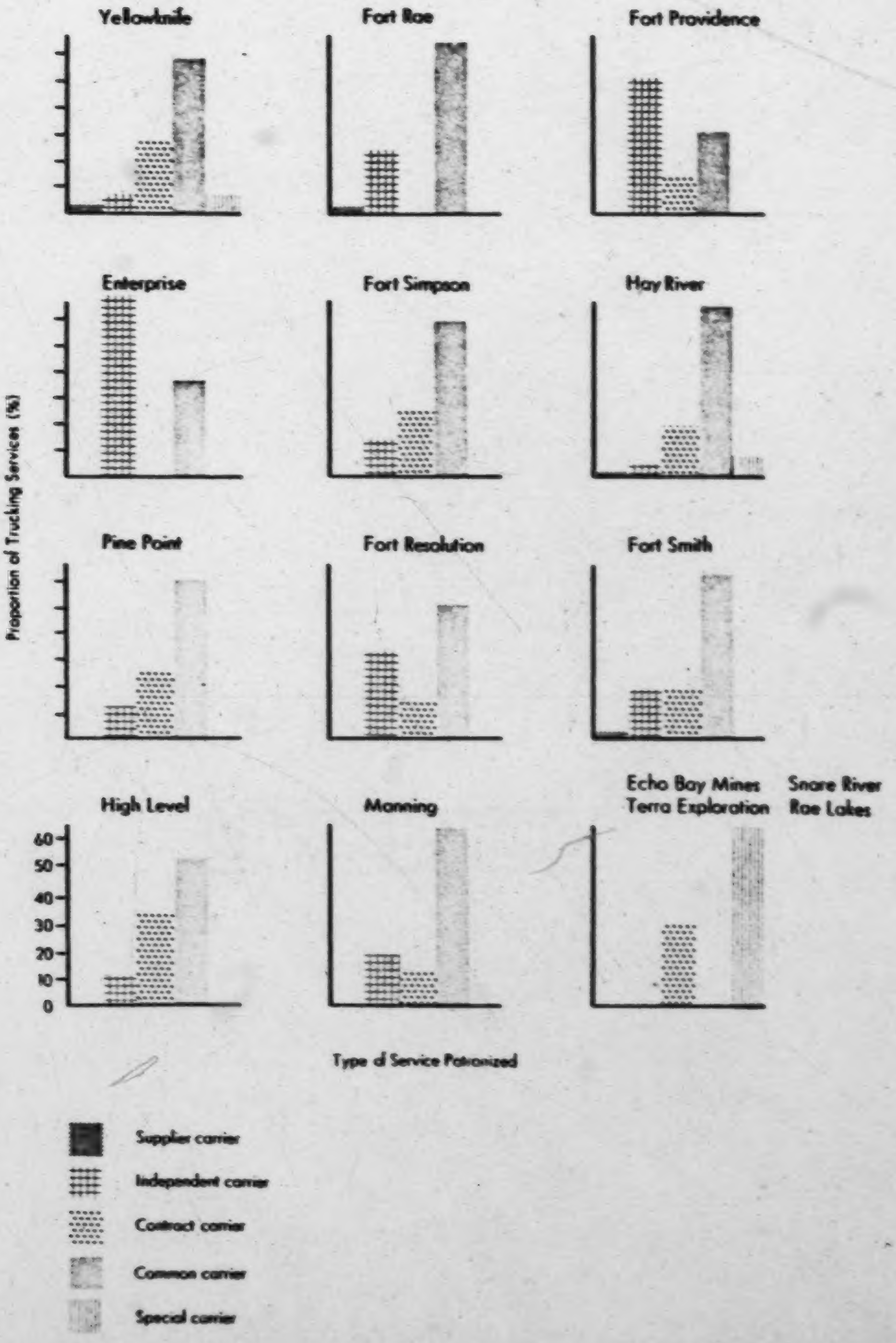
In general, the demand for common carrier service seems to be higher in the large settlements such as Yellowknife, Hay River, Fort Smith, and Fort Simpson, where the number of clients served is greatest (Appendix E). The significance of Hay River as the "transportation hub of the North"[13] is emphasized by the dependence of clients in the town on scheduled common carrier service.[14]

The emphasis on common carrier service shown for Fort Rae and Fort Resolution clients in Figure 5.1 is somewhat misleading. In both communities, Pacific Western Trucking or Grimshaw Trucking and Distribution[15] -- common carrier companies -- supply scheduled carrier service on an annual contract basis for the Hudson's Bay Company. General freight deliveries, which are arranged for other clients in Rae and Resolution as part of the general carrier agreements, help to increase revenues per ton-mile over these low-volume routes.

Contract and independent carrier services are more important in the small service-oriented settlements such as Fort Providence and Enterprise (Figure 16). The high proportion of traffic handled by contract and supplier carriers for clients in Fort Providence (65%), Enterprise (60%), Pine Point (50%), and Fort Resolution (48%), reflect the disproportionate volume of heavy bulk commodities -- in particular, gasoline and diesel fuel -- distri-

Figure 16

TRUCKING SERVICES PATRONIZED ACCORDING TO LOCATION 1972



buted to these communities. Enterprise and Fort Providence are important re-fuelling centres for motor carriers (and tourists in the summer) on the Mackenzie and Yellowknife Highways. Much of the specialized heavy equipment used in the Cominco operation at Pine Point is delivered by contract carriers.

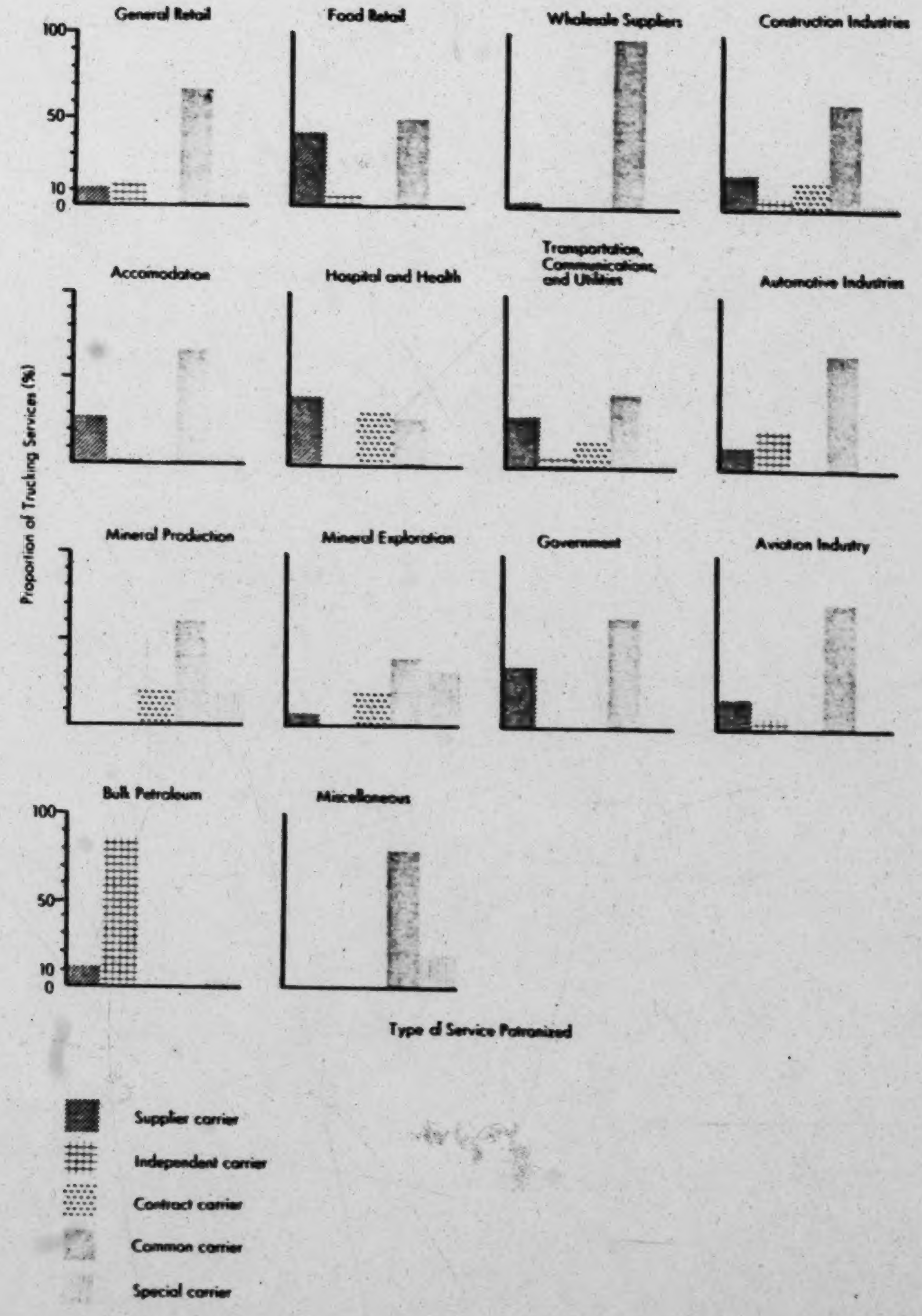
The dependence of business functions on the various types of trucking services does not vary significantly between the major settlements. However, clients in the small, relatively more isolated communities have less flexibility in the choice between various types of service. Low-volume business functions and settlements rarely attract the most reliable and competitive carriers.

An analysis of the trucking services used by each business function for all communities demonstrates that there is a strong relationship between the type of carrier service most frequently used, the nature of commodities shipped, the average size of shipments, and freight service requirements characteristic of each business function (Figure 17).

Business and industrial functions characterized by heavy, bulk, or trailer-load shipments show the greatest dependence on independent carriers retained under contract. The most important customers of independent carriers are

Figure 17

TRUCKING SERVICES PATRONIZED ACCORDING TO BUSINESS FUNCTION 1972



bulk petroleum distributors (86.0%), the automotive repair and mechanical industries (22.0%), mineral production (20.0%), and exploration (20.0%), and the construction industries (13.5%). Since most businesses in these classifications can specify minimum annual volumes and guarantee trailer-load traffic, preferential commodity rates are often obtained from independent carriers who rely on secure revenue traffic (e.g., Joe Klone's, and Argue Transport -- bulk petroleum haulers -- Hay River, United Auto Carriers -- automobile carriers, Caron's Transport -- bulk chemical carriers, Edmonton).

Clients who rely upon their suppliers to secure or provide carrier services often require special handling considerations, such as heated, or refrigerated service. About 12.9 per cent of the clients surveyed reported that their trucking services were arranged by suppliers. Food retailers, who demand reliable and efficient trucking service to minimize transit damage and perishable losses, are heavily reliant on supplier carrier service.[16] Furthermore, other business functions, such as hospital and health, the government sector, and visitor-accommodation which utilize supplier carriers, receive a large volume of perishable commodities by truck.

Contract agreements between suppliers and the transportation, communication, and utility industries, often stipulate that the supplier must provide the necessary cargo-handling and delivery services. Special equipment is often required to ensure safe delivery of communication and other utility service equipment (e.g., transformers, metering devices, transmission cable, etc.). Approximately thirty per cent of the trucking services required in these industries are provided by suppliers.

Small shippers, who cannot guarantee regular, or truckload traffic are the largest users of common carrier services. Nearly all business functions on the Mackenzie Valley Highway system depend upon common carriers for a significant proportion of their total trucking services; especially for less-than-trailer-load shipments, emergency parts or equipment, and non-perishables. The major advantages of common carriers are scheduled service, point-to-point delivery, acceptance of all cargo on an equal basis (with no long-term commitment to patronize a specific carrier), and published tariffs.

Northbound Truck Shipments

The average number of truck shipments received per week by clients in the Mackenzie Valley varies according to location. In general (although there are several exceptions), the average number of shipments received by clients per week increases as the population of the community increases, but also depends upon the nature and number of business functions located in each community (Figure 18).

Clients in mining-based communities such as Yellowknife, Pine Point, and the important trans-shipment centre of Hay River receive a relatively large number of shipments per week (Table 14). High values for Manning and for High Level reflect the larger market areas served from these centres and specific service functions located in these communities. Oil exploration and production has become very important in the High Level area, which probably explains the higher value obtained for High Level (2.82 shipments per client per week) compared to Manning (2.39 shipments per client per week).

The average content weight of northbound truck shipments received by all clients in each community (Table 14) is not directly related to population. Clients in the small, service-oriented communities (e.g., Fort Rae, Fort Resolution, Fort Providence, and Enterprise) receive fewer truck shipments per week. The disproportionate volume of trailer-load traffic (especially of bulk petroleum to Enterprise and Fort Providence, and of Hudson's Bay cargo to Rae and Resolution) to these centres limits the value of comparing the average content weight of northbound shipments with other settlements in the Valley (Table 14).

Figure 18

AVERAGE NUMBER OF TRUCK SHIPMENTS RECEIVED EACH WEEK COMPARED TO THE NUMBER OF BUSINESS FUNCTIONS IN EACH COMMUNITY

1972

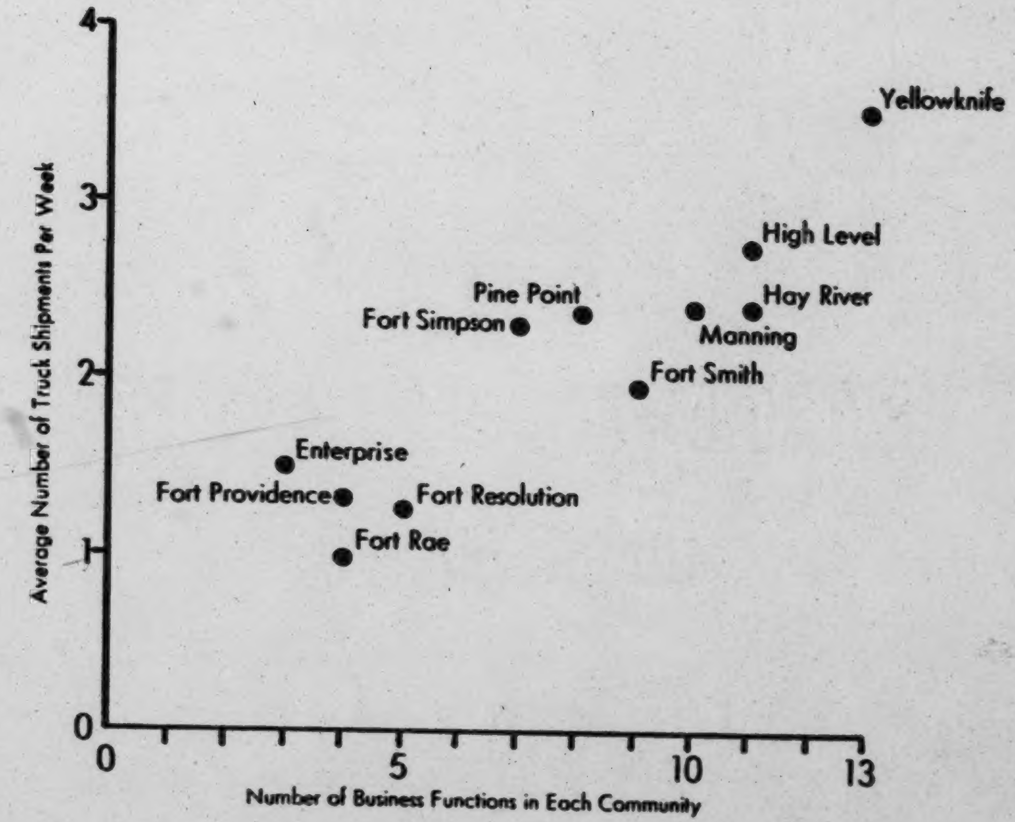


TABLE 14

CHARACTERISTICS OF NORTHBOUND TRUCK SHIPMENTS RECEIVED IN EACH COMMUNITY--1972

Community	Average Number of Truck Shipments Received Per Week	Average weight (lbs) of Shipments Received
Yellowknife	3.63	11486
Rae-Edzo	1.00	9416
Fort Providence	1.33	11425
Enterprise	1.50	20150
Fort Simpson	2.25	5876
Hay River	2.38	6940
Pine Point	2.29	10735
Fort Smith	1.93	13742
Fort Resolution	1.25	7467
High Level	2.82	6690
Manning	2.39	4262

Comparisons based on the average content weight of northbound shipments "... are almost certain to overstate the importance of transporting heavy, bulky commodities ..."[17] to small settlements.

Consideration of the average content weight of northbound shipments received by clients in each business function provide a more reliable basis to explain differences in shipping demands which occur. This data is especially useful when the average number of shipments received per week, and the proportion of trailer-load shipments[18] received by all clients in each business function are also known.

Mineral producers in the area are heavily reliant upon truck transport for chemical reagents, explosives, chemicals, and equipment parts or replacements required in the daily mine and mill operations. The major mine operations included in this survey[19] receive an average of twenty-one truck shipments per week. Thirty-eight per cent of all northbound mining shipments are trailer-load, and the average weight of northbound mine shipments in the Valley is about twenty-three thousand pounds (Table 15).

Scheduled, all-season trucking services have been a tremendous advantage to northern mine operators. Daily service has permitted a significant reduction in mine inventories and operating costs.[20] For similar reasons, northern food retailers, wholesale merchants, and the utility industries are important northern trucking clients, who frequently receive large truck shipments on a year-round basis (e.g., food retailers average 2.6 northbound shipments of about 15,500 pounds per week -- 26% of all shipments are trailer-load -- Table 15).

The large average content weight, and the high proportion of trailer-load shipments received by clients in the air transport industry[21] reflects the supply service provided by this industry to remote exploration and mining properties. Seasonal fluctuations in demand for trucking service by the air transport industry are common, but the importance of winter trans-shipment services from Yellowknife (truck-air), Fort Simpson (truck-air), and Hay River (truck-air and rail-air) has increased steadily in the last decade. The high proportion of trailer-load traffic (56.4%) received by aviation clients is a result of efforts by mining operators and exploration companies to work together to consolidate northbound shipments,[22] and secure lower transportation rates from motor carriers.

Local service-oriented and retail business functions typically receive numerous small shipments, and a very low proportion of truckload traffic. For clients in the general retail, accommodation, construction, automo-

TABLE 15

CHARACTERISTICS OF NORTHBOUND TRUCK SHIPMENTS RECEIVED BY EACH BUSINESS FUNCTION--1972

Business Function	Average Weight (lbs) of Shipments Received	Average Number of Truck Shipments Received per Week	Proportion of Shipments Trailer-load[a]
General retail	3832.8	2.5	13.1
Food retail	15487.5	2.6	26.0
Wholesaler	14500.0	1.3	50.0
Construction	6414.9	2.5	16.4
Accommodation	557.3	2.8	3.2
Hospital/health	1328.6	4.0	7.1
Transportation/utilities	13250.0	1.4	28.4
Automotive	8118.6	2.3	21.9
Mineral production	23000.0	21.0	38.0
Mineral exploration	1900.0	2.0	14.0
Government	6097.7	2.1	12.3
Aviation industry	25636.4	2.0	56.4
Bulk petroleum	39750.0	2.5	88.1
Misc.	2255.0	2.0	18.0

Notes: [a] A trailer-load is normally considered as 40,000 lb. unless otherwise specified.

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tive, government, and health functions, scheduled daily trucking services are essential to meet short-term changes in demand, regular re-supply requirements, and emergency situations.[23] In the larger settlements where general services and government functions are relatively more important (e.g., Yellowknife, Fort Smith, High Level, and Hay River), the average number of shipments received each week by clients is also high. For example, in the large mining and government centre of Yellowknife, the average number of shipments received by all clients each week is significantly greater than for other communities in the study area (Table 14). Compared to most other centres, a greater proportion of shipments to Yellowknife are trailer-load, but there is also a greater range in the average size of shipments handled on the Yellowknife run,[24] which reflects the diversity of trucking requirements for business and service functions located in the community.

Volume of Northbound Commodity Traffic

In 1972,[25] approximately 108,000 tons of freight was carried by common and contract carriers to settlements in the Mackenzie Valley (Table 16). This compares to 40,000 tons[26] of freight delivered by motor carriers to settlements and operations in the area during 1968.[27] Between 1968 and 1972, the volume of northbound motor carrier freight traffic increased by more than twenty per

TABLE 16

TOTAL VOLUME OF NORTHBOUND TRUCK SHIPMENTS TO LOCATIONS IN THE MACKENZIE VALLEY--1972

Location	Volume of Shipments (Tons)
Yellowknife	36074
Rae-Edzo	1038
Fort Providence	596
Fort Simpson	1127
Enterprise	188
Hay River	17598
Pine Point	5283
Fort Smith	4191
Fort Resolution	437
Fort Vermillion	1655
La Crete	430
High Level	14362
Manning	13328
Echo Bay Mines	1500
Terra Mining	1000
Rae Lakes	121
Lac la Martre	125
Snare River	105
Taltson River	220
Rainbow Lake	3750
Zama Lake	4980
Total	108108

TABLE 17

POPULATION AND VOLUME OF FREIGHT RECEIVED PER CAPITA AT LOCATIONS IN THE MACKENZIE VALLEY--1972

Community	Population	Volume of Freight Received Per Capita (Tons)
Yellowknife	5697	6.33
Rae-Edzo	1473	0.70
Providence	587	1.01
Enterprise	56	3.35
Simpson	747	1.51
Hay River	2420	7.27
Pine Point	1225	4.31
Smith	2372	1.77
Resolution	623	0.70
High Level	1621	8.86
Manning	1204	11.06
Echo Bay Mines	225	6.66
Terra Mining	125	8.00
Rae Lakes	73	1.66
Lac la Martre	161	0.78

cent a year. Only a small proportion of the increase in total freight volume is due to the creation of road access to formerly isolated communities (e.g., Fort Simpson and Fort Resolution).

The total volume (tons) of freight received in each community is not directly related to population, but depends upon the nature and number of business functions located in the community (Figure 19). Small native communities (Fort Rae, Fort Resolution, Rae Lakes, and Lac la Martre), service-oriented, and local government centres (e.g., Fort Providence, Fort Simpson, Fort Smith, Fort Vermilion, and La Crete), which support a fewer number of business functions, and only limited economic activity, receive relatively smaller volumes of freight per capita (0.70 to 1.76 tons per capita). Resource-based centres (e.g., Pine Point, Echo Bay Mines, and Terra Mining), and large regional service centres (e.g., Hay River, High Level, Manning, and Yellowknife) receive a larger volume of freight per capita (4.3 to 11.6 tons per capita). The large volume of freight received per capita in Enterprise, and at the Snare and Taltson River hydro-electric generating stations merely reflect the disproportionate volume of heavy bulk fuel deliveries to these centres (Figure 20) and the small population base of each centre (Table 21).

Fuels, lubricants, and other petroleum products

Figure 19

TRAFFIC VOLUME (TONS) TO EACH COMMUNITY COMPARED TO THE NUMBER OF BUSINESS FUNCTIONS 1972

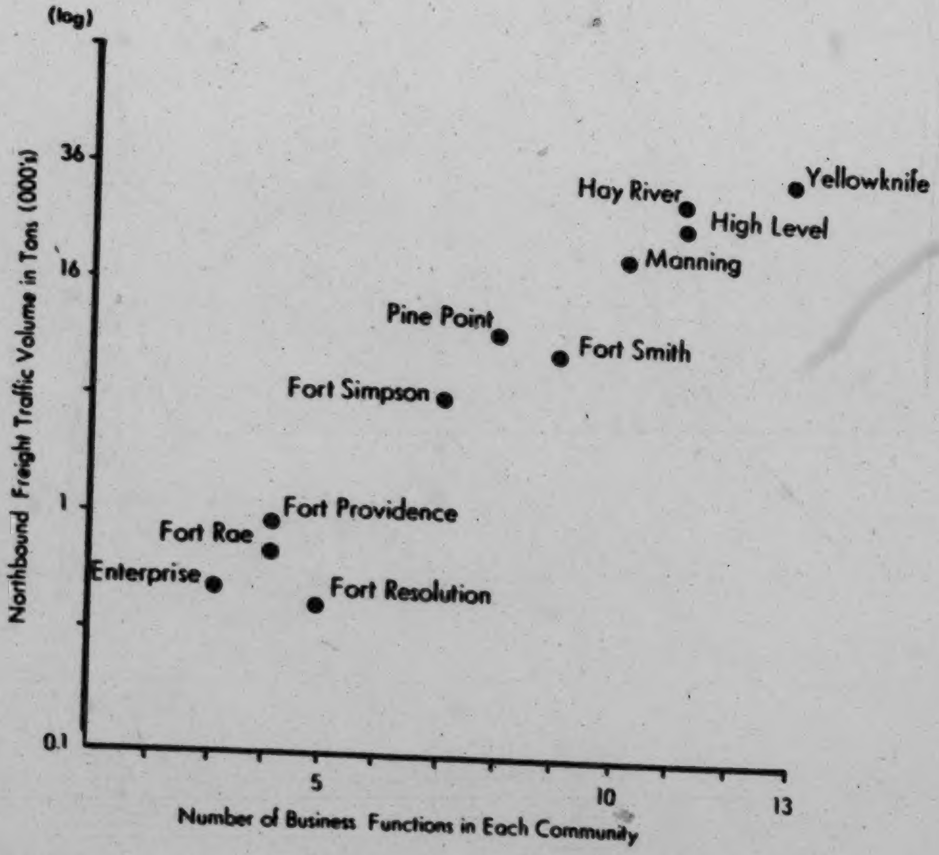
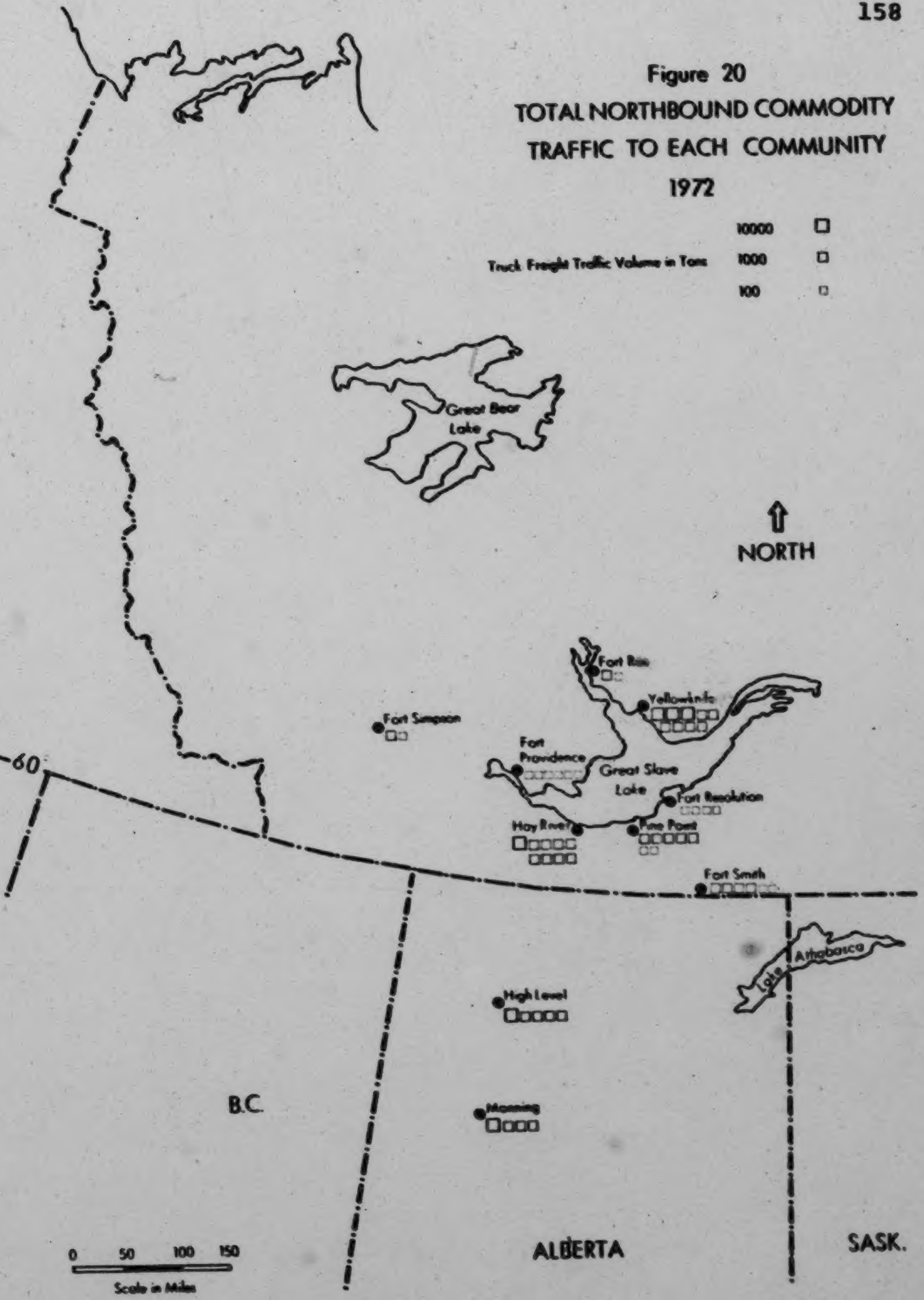


Figure 20

TOTAL NORTHBOUND COMMODITY TRAFFIC TO EACH COMMUNITY

1972


10000 □
Truck Freight Traffic Volume in Tons 1000 □
100 □
Great Bear Lake
NORTH
Fort Rae
Yellowknife
Fort Simpson
Fort Providence
Great Slave Lake
Fort Resolution
Hay River
Pine Point
Fort Smith
60
Lake Athabasca
High Level
Manning
B.C.
ALBERTA
SASK.
0 50 100 150
Scale in Miles

comprised over one-third (34.7%) of the total freight volume (by weight) carried by motor transport to communities in the Mackenzie Valley during 1972. Construction materials, machinery, parts and equipment, non-perishable foods, and mine supply shipments accounted for about 35.5 per cent of the total northbound traffic. Perishable foods (meats and produce), mixed grocery shipments, hard goods, soft goods, general retail merchandise,[28] automotive supplies (including automobiles), and chemicals (mainly explosives, reagents, and medical supplies) were other important commodity groups identified in the survey (Table 18).

Statistics compiled for the total volume of freight received by each business function in all communities are not very useful since the values obtained (Table 19) mask the significance of variations in the total volume of shipments received by particular business functions in specific locations. For example, over seventy per cent (11,754 tons) of the total volume of traffic (16,123 tons) carried to transportation, communication, and utility business functions in the Valley terminated at Hay River.[29] Information on the total volume of traffic to individual communities, according to business functions or commodity groups, provide a more reliable indication of northbound commodity flows (Table 20, Table 21, and Figure 20).

TABLE 18

TOTAL VOLUME OF NORTHBOUND FREIGHT SHIPMENTS DELIVERED BY MOTOR CARRIER TO SETTLEMENTS[a] IN THE MACKENZIE VALLEY AREA (BY COMMODITY CLASSIFICATION)--1972

Commodity Group	Total Volume (Tons)
Meats	2041
Produce	1563
Dry groceries	8345
Mixed grocery orders	5596
Machinery, parts, equipment	8061
Construction materials	10146
Hardware, drygoods	5632
Fuels, lubricants	34304
Soft goods	1371
General retail merchandise	2326
Mine supplies	8015
Drugs, chemicals, explosives	338
Automotive supplies	4531
Other (NOIBN)[b]	5787
Total-all commodity groups	98056

Notes: [a] Fort Vermilion, La Crete, Rainbow, and Zama Lake are not included.

[b] Freight shipments--"not otherwise specified by name."

TABLE 19

TOTAL VOLUME OF NORTHBOUND FREIGHT SHIPMENTS DELIVERED BY MOTOR CARRIER TO SETTLEMENTS[a] IN THE MACKENZIE VALLEY AREA (BY BUSINESS FUNCTION)--1972

Business Function	Total Volume (Tons)
General retail	9119
Food retail	10627
Wholesale	1555
Construction	10103
Accommodation	1000
Hospital/health	478
Transportation/utilities	16337
Automotive	3567
Mineral production	14850
Mineral exploration	937
Government	5636
Aviation industry	8930
Bulk petroleum	14275
Misc.	642
Total--all business functions	98056

Notes: [a] Fort Vermilion, La Crete, Rainbow and Zama Lake are not included.

TABLE 22

VOLUME OF NORTHBOUND SHIPMENTS RECEIVED BY BUSINESS FUNCTIONS IN EACH COMMUNITY--1972[a]

Volume of Truck Freight to Community in Tons

Business Function	Yellowknife	Rae-Edzo	Ft. Providence	Enterprise	Ft. Simpson	Hay River	Pine Point	Ft. Smith	Ft. Resolution	High Level	Manning	Echo Bay - Terra	Rae Lakes - Lac La Martre	Snare Falls-Thalston River	Total for Each Business Function
General retail merchant	4046	858	165	-	717	1006	23	1873	210	112	59	-	-	-	9119
Food retailer	3947	-	-	-	-	1500	950	425	-	2830	975	-	-	-	10627
Wholesaler	600	-	-	-	-	955	-	-	-	-	-	-	-	-	1555
Construction industries	5285	-	-	-	10	1398	-	622	14	2602	172	-	-	-	10103
Accommodation	145	-	100	13	26	133	52	120	-	342	64	-	-	-	1000
Hospital/health	110	45	15	-	48	55	-	135	-	-	80	-	-	-	478
Trans./comm./util.	3739	-	-	-	147	11754	95	180	22	5	70	-	-	325	16337
Automotive	247	125	310	175	55	306	95	269	180	1432	373	-	-	-	3567
Mineral production	8450	-	-	-	-	-	3900	-	-	-	-	2500	-	-	14850
Mineral exploration	15	-	-	-	-	-	35	87	-	800	-	-	-	-	937
Government	4215	14	-	-	124	11	133	480	11	277	125	-	246	-	5636
Aviation industry	5190	-	-	-	-	-	-	-	-	3740	-	-	-	-	8930
Bulk petroleum	b	b	b	625[c]	b	30[d]	b	b	b	2220	11400	b	b	b	14275
Misc.	85	-	-	-	-	545	-	-	-	2	10	-	-	-	642
Total	36074	1032	590	813	1127	17743	5283	4191	437	14362	13328	2500	246	325	98056
Number of business functions	13	4	4	3	7	11	8	9	5	11	10	1	1	1	

Notes:

[a] Data for Fort Vermilion, La Crete, Rainbow Lake and Zama Lake are not included.

[b] Bulk petroleum supplies are transhipped by truck from barge or rail.

[c] Principally diesel, and gasoline fuels.

[d] Mainly high quality lubricants and special orders. Bulk petroleum dealers in Hay River utilize rail services almost exclusively for northbound freight shipments received in Hay River.

TABLE 21

VOLUME OF NORTHBOUND SHIPMENTS RECEIVED IN EACH COMMUNITY BY COMMODITY CLASSIFICATION--1972

Volume of Truck Freight to Community in Tons

Commodity Group	Yellowknife	Rae-Edzo	Ft. Providence	Enterprise	Ft. Simpson	Hay River	Pine Point	Ft. Smith	Ft. Resolution	High Level	Manning	Echo Bay - Terra	Rae Lakes - Lac La Martre	Snare Falls - Thalston River	Total for Each Commodity Classification
Meats	719.5	-	-	-	-	-	171.0	42.5	136.5	844.0	127.5	-	-	-	2041.0
Produce	673.7	-	-	-	-	300.0	66.5	85.0	-	228.4	210.0	-	-	-	1563.6
Dry groceries	3698.2	-	-	-	-	900.0	712.5	297.5	-	2095.6	512.5	-	129.0	-	8345.9
Mixed groceries	1535.1	654.7	203.4	19.1	393.7	1196.5	8.0	1161.2	-	325.2	99.5	-	-	-	5596.7
Machinery, parts	1384.0	1.8	-	-	82.8	2380.4	2015.0	21.5	18.7	1264.4	422.6	440.0	-	30.5	8061.7
Construction mat.	6945.9	10.8	7.0	-	178.0	681.6	-	684.0	14.4	1344.4	55.0	225.0	-	-	10146.1
Hardware, drygoods	1262.2	111.2	24.7	-	102.2	737.6	2049.0	384.4	42.0	701.2	217.6	-	-	-	5632.1
Fuels, lubricants	4363.0	130.4	287.2	625.0	33.2	9362.5	16.5	919.0	190.0	6937.6	1067.7	450.0	49.2	269.3	34304.6
Soft goods	116.1	111.2	24.7	-	109.0	394.4	16.0	389.8	31.5	90.0	88.5	-	-	-	3371.2
General retail merchandise	1043.2	1.0	21.2	-	26.0	792.7	9.8	84.0	2.2	222.8	55.5	-	67.6	-	2326.0
Mine Supplies	6620.0	-	-	-	-	-	10.5	-	-	-	-	1385.0	-	-	8015.5
Chemicals, drugs	69.0	9.0	4.5	-	28.8	14.4	23.5	111.6	-	29.4	48.0	-	-	-	338.2
Other	3741.3	1.9	0.3	2.7	158.3	365.0	113.4	6.5	-	57.3	30.0	-	-	25.2	4531.9
Automotive Sup.	3803.4	-	17.0	166.2	15.0	617.8	71.3	4.0	1.7	201.7	789.6	-	-	-	5787.8
Totals for Each Community	36074	1032	590	813	1127	17743	5283	4191	437	14362	13328	2500	246	325	98,056

Fuel shipments to bulk petroleum dealers located in Manning represent an anomaly which is identified by the presentation of shipment data for each community according to business functions and commodities. Almost one hundred per cent of bulk petroleum supplies used or distributed from Manning are delivered by motor carrier from Peace River. Bulk dealers based in Manning provide delivery services to dealers located on the Mackenzie Highway, south of the Northwest Territories border. A few dealers located in Fort Vermilion and La Crete, and clients in isolated exploration and lumber camps off the highway, are also served from Manning.

North of the sixtieth parallel, bulk shipments are principally delivered by rail to Hay River,[30] where they are distributed to bulk oil dealers in the settlements around Great Slave Lake and on the Mackenzie and Yellowknife Highway systems. Significant quantities of petroleum products (mainly diesel, bunker, and heating oil) are also delivered to Yellowknife, Hay River, and Fort Simpson by barge from Norman Wells.[31] In 1972, more than 750 tons of gasoline and diesel fuel were delivered by winter road operators to the mining installations at Port Radium and Terra, native settlements at Rae Lakes and Lac la Martre, and hydro-electric stations on the Snare and Taltson Rivers (Table 21).

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Information compiled on the total volume of freight in each commodity-group received in each settlement, permit us to estimate the type of equipment most commonly used on northern trucking operations (Table 22). Closed van-trailers carry about forty-four per cent (44.1%) of all commodity traffic in the Mackenzie Valley. The high proportion of traffic moving in closed vans reflects the special packaging and handling precautions which are necessary on most northern carrier runs to compensate for poor road and environmental conditions. Many northern clients demand closed-van trailer service on shipments which might normally be carried on open-deck trailers, in an effort to reduce transit damage due to road shocks, exposure, dust, and flying stones. Custom shock-reducing equipment is utilized by many northern carriers, but clients are usually required to provide special packaging for delicate shipments.[32]

Southbound Truck Shipments

No estimates of total southbound truck freight volumes were obtained, but northern motor carrier clients were asked to supply information about the average size of their southbound shipments, and how frequently southbound shipments were made. Over sixty per cent of the clients surveyed reported that they never or very rarely make southbound shipments. On the average, only about

TABLE 22

TYPE OF TRANSPORT EQUIPMENT UTILIZED ON NORTHERN MOTOR CARRIER OPERATIONS--1972

Type of Equipment	Commodities Carried	Estimated Tonnage	Proportion of Total Freight Volume (%)
tank-trailer	liquid/dry bulk	32260	32.9
van-trailers (not temperature controlled)	general retail merch. dry goods/soft goods automotive/mine supplies dry groceries machinery, parts... construction materials	34025	34.7
van-trailers (refrigerated-heated service)	meats produce mixed groceries drugs	9218	9.4
high-deck trailers ("hi-boy")	construction materials machinery, parts... mine supplies	7158	7.3
low-bed trailers ("lo-boy")	heavy equipment construction materials	7746	7.9
other	other	7649	7.8
	Total	98056	100.0

twenty per cent of the clients in each settlement make regular southbound shipments. However, there is no consistent pattern from one settlement to another (Table 23).

The larger centres (Hay River, Yellowknife, and Fort Smith) seem to generate relatively fewer southbound truck shipments, however, this is due to data problems. Small centres, such as Fort Rae or Fort Providence have relatively few business functions dependent upon trucking services. The significance of one or two clients who make regular southbound shipments is tremendously overstated for these settlements in Table 23. Information obtained on the average content weight of southbound shipment from each community is more useful (Table 24).

In general, the small, service-oriented communities such as Fort Rae, Fort Simpson and Fort Providence generate small southbound shipments. Damaged or defective merchandise, core parts, trade-in equipment, machinery for repair, and exchange containers[33] are the most common southbound shipments originating in these settlements. The relatively large average content weight of southbound shipments from Fort Resolution and High Level emphasizes the importance of sawmilling and lumber exports in these communities. The dependence of the Cominco open-pit mining operations at Pine Point (Plate 7) on industrial suppliers and services in Hay River explains the high value for southbound ship-

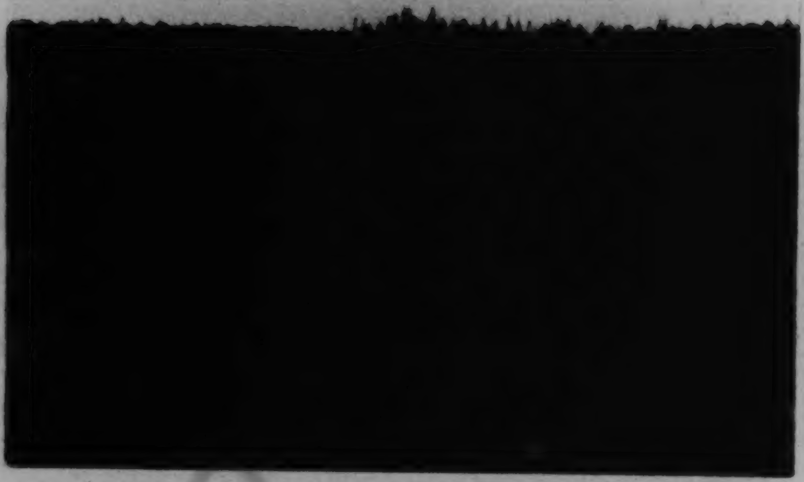

Plate 7. Pine Point Mines Limited, Pine Point, N. W. T.

TABLE 23

SOUTHBOUND MOTOR CARRIER SHIPMENTS--1972

Community	Average Weight (lbs) of Southbound Shipments Discharged	Proportion of Clients Who Discharged Southbound Shipments on a Regular Basis
Yellowknife	679	10
Rae-Edzo	71	22
Fort Providence	64	17
Enterprise	32	-
Fort Simpson	182	23
Hay River	1032	15
Pine Point	3589	35
Fort Smith	152	15
Fort Resolution	3627	34
High Level	6727	22
Manning	1177	20
Average for all Communities	1575	19.4

TABLE 24

AVERAGE WEIGHTS OF SOUTHBOUND SHIPMENTS FROM BUSINESS FUNCTIONS IN ALL COMMUNITIES--1972

Business Function	Average Weight of Southbound Shipments (lbs)
General Retail	592.4
Food	913.4
Wholesaler	716.7
Construction	7001.5
Accommodation	44.4
Hospital/health	35.7
Transportation/utilities	141.3
Automotive	208.3
Mineral Production	23140.0
Mineral Exploration	915.0
Government	95.0
Aviation Industry	59.1
Bulk Petroleum	7130.0
Misc.	1376.3

ments from Pine Point.[34]

These data on southbound shipments (Table 23) support the general observation that "backhaul" traffic volumes are less than twenty per cent[35] of the total northbound commodity flow handled by truck in the Mackenzie Valley. The amount of southbound or "backhaul" traffic available in the Valley varies considerably according to season and location. The possibilities of directing empty units to secure this traffic are limited, especially considering the physical distances which separate many communities, and the paucity of trailer-load southbound traffic.

The nature of southbound shipments originating in Yellowknife and Hay River is basically similar to the southbound traffic from smaller settlements. Empty containers and defective merchandise are the principal commodities discharged from these centres. However, ore concentrate (e.g., Terra and Echo Bay Mines via Hay River), drill core and assay samples (Hay River and Yellowknife), raw furs, native handicrafts,[36] and frozen fish[37] are frequently handled.

The average content weight of southbound shipments does not vary significantly according to business function. Southbound shipments for all businesses, except the construction and mineral producing industries[38] average at least ten times smaller (by content weight) than northbound shipments, and are discharged less frequently (Table 24). Only 36.2 per cent of all the clients surveyed make southbound shipments on a regular basis (Table 25). Over seventy per cent of the clients who make regular southbound shipments are based in Yellowknife, Hay River, Fort Smith, and Fort Simpson.

Ton-mile Considerations

Many transport researchers have attempted to devise a standard measure of transportation service, but the heterogeneous nature of the transportation industry seems to preclude the development of a standard unit of "output" which is universally applicable. Under the circumstances, transportation statisticians and analysts have had to accept the most functional alternative -- the ton-mile.[39] Norton concludes:

> *It seems clear that the ton-mile, while by no means a homogeneous unit, is the only practical unit of output measurement.*[40]

Ton-mile measures of transport output do not discriminate between short-distance, high-tonnage hauls, and long-distance, low-tonnage hauls. However, since the average length-of-haul in the Mackenzie Valley exceeds 750 miles, and more than seventy per cent of northbound

TABLE 25

PROPORTION OF MOTOR CARRIER CLIENTS ACCORDING TO BUSINESS FUNCTION WHO DISCHARGE SOUTHBOUND TRAFFIC ON A REGULAR BASIS--1972

Business Function	Regular Shipments	Non-Regular Shipments	Number Responses
General retail	46.3	53.7	41
Food retail	43.8	56.3	16
Wholesaler	100.0		3
Construction	37.8	62.2	37
Automotive	22.6	77.4	31
Accommodation	22.6	77.4	31
Hospital/health	-	100.0	7
Transp./commun.	24.0	76.0	50
Mineral production	60.0	40.0	5
Mineral exploration	60.0	40.0	5
Government	54.5	45.5	22
Aviation industry	-	100.0	11
Bulk petroleum	60.0	40.0	5
Other	87.5	12.5	8
Total	36.2	63.8	271

shipments are trailer-load,[41] the disadvantages of ton-mile measures are not so significant in northern motor carrier traffic studies. As well, ton-mile measures provide the only reliable basis for comparing the utilization of northern motor carrier services with alternate modes of transport in the area.[42]

Basic ton-mile data for northern motor carrier service to settlements and operations in the Mackenzie Valley are given in Table 26. Shortest distance road mileages from Edmonton were used in the ton-mile calculations since about ninety per cent of the clients surveyed indicated that over eighty-five per cent of the total volume (by weight) of truck shipments received in 1972, originated or were transhipped in Edmonton.[43] The association[44] which is demonstrated between ton-mile measurements and population for northern settlements seems to indicate that ton-mile considerations may be useful for future northern traffic analyses and in predictive studies.[45] Ton-mile statistics for northern motor carrier traffic also provide a useful method of representing the distribution of motor carrier traffic flows in the Mackenzie Valley (Figure 21).

Summary

The determination of motor carrier freight traffic

TABLE 26

TON-MILE NORTHBOUND SHIPMENT DATA--1972

Community	Population	Tons	Road Miles From Edmonton	Ton-Miles	Ton-Miles Per Capita
Yellowknife	5697	36,074	947	34,162,078	5996
Rae-Edzo	1473	1,032	882	915,516	621
Fort Providence	587	590	756	450,576	767
Enterprise	56	813	667	542,271	9683
Fort Simpson	747	1,127	912	1,027,824	1375
Hay River	2420	17,743	694	12,213,012	5046
Pine Point	1225	5,283	738	3,898,854	3182
Fort Smith	2372	4,191	852	3,570,732	1505
Fort Resolution	623	437	781	341,297	547
Fort Vermilion	946	1,655[a]	533	882,115	932
La Crete	247	430[a]	550	236,500	967
High Level	1621	14,362	486	6,979,932	4305
Manning	1204	13,328	364	4,851,392	4029
Rainbow Lake	580	3,750[a]	572	2,145,000	3698
Zama Lake	765	4,980[a]	522	2,604,500	3404
Port Radium	225	1,500	1232	1,848,000	8213
Terra	125	1,000	1182	1,182,000	9456
Rae Lakes	73	121	1002	121,242	1660
Lac la Martre	161	125	942	117,750	731
Snare River	5	105	917	96,285	19,257
Thalston River	5	220	892	196,240	39,248
Total	22,503	108,866		78,383,116	
Average ton-miles freight per capita					3507[b]

Notes: [a] estimated.

[b] Snare River and Thalston River data are not included.

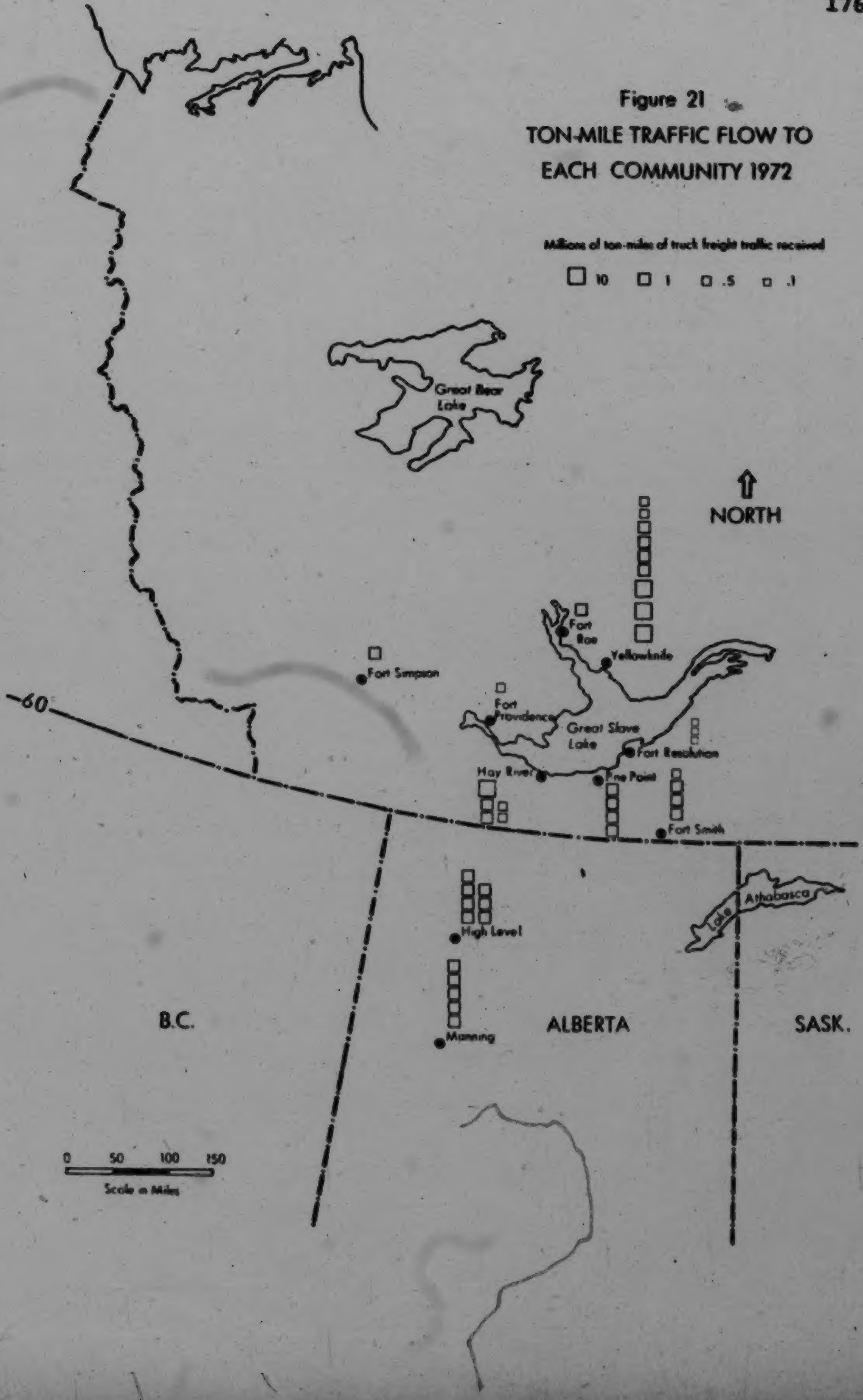

Figure 21
TON-MILE TRAFFIC FLOW TO EACH COMMUNITY 1972

Millions of ton-miles of truck freight traffic received
10
1
.5
.1
NORTH
Great Bear Lake
Fort Rae
Yellowknife
Fort Simpson
Fort Providence
Great Slave Lake
Fort Resolution
Hay River
Pine Point
Fort Smith
60
High Level
Lake Athabasca
Manning
B.C.
ALBERTA
SASK.
0
50
100
150
Scale in Miles

volumes in the Mackenzie Valley is complicated by the highly competitive nature of the industry, and the lack of reliable traffic records maintained by many motor carrier clients and operators in the area. Basic information on the volume and nature of truck freight shipments received by clients in the Mackenzie Valley was obtained by questionnaire-survey and interviews. The volume of traffic to each community or centre in the Valley depends upon the number and type of business functions located in the settlement. In general, resource-based communities and communities with a large number of business and service functions, receive a disproportionate volume of traffic on a per capita basis (e.g., Yellowknife, Hay River, and Pine Point). Native and small, local service centres receive comparatively less freight per capita. Contract, independent, and supplier carriers are important in the Valley, especially for bulk and off-highway shipments. However, the majority of clients are heavily reliant on common carrier service. During the 1972 operating season,[46] approximately 108,000 tons, or 78,400,000 ton-miles of freight traffic was handled by common and contract carriers operating in the Mackenzie Valley. The total volume of traffic handled by motor carriers in the Valley has increased by about twenty per cent a year during the last five years. The rate of growth in the next decade will depend largely upon the success of mineral and hydrocarbon exploration and developments in the area, and the pace of extension and improvement of the northern road network.

FOOTNOTES

CHAPTER 5

[1] W. Isard, *Methods of Regional Analysis* (Cambridge: Massachusetts Institute of Technology, 1967), pp. 126-127.

[2] H. McCarty and J. Lindberg, *Economic Biography* (Englewood Cliffs: Prentice-Hall, 1966), p. 157.

[3] For example, ton-miles or passenger-miles.

[4] McCarty, *loc cit*.

[5] Isard, *Ibid*., pp. 122-178.

[6] H. S. Norton, *Modern Transportation Economics* (Columbus: Merrill, 1971), *passim*.

[7] Isard, *Ibid*., pp. 214-217, and McCarty, *Ibid*., pp. 19-23.

[8] The terms "community" and "centre" are used rather loosely in this analysis. In general, a community may be considered as a settlement having two or more business functions located in the settlement. Centres have only one function, usually mineral production or hydro-electric generation.

[9] Therefore, the total response, including questionnaire (51.3%), and interview results (28.4%) was 79.7%.

[10] For example, small specialty retail and service stores such as camera, drug, confectionary, and beauty shops receive less than 10 tons of freight by truck per year (i.e., per business).

[11] The reader is reminded that only common and contract carrier shipments terminating in the settlements are considered unless otherwise specified.

[12] Pers. communication, J. Mann, Purchasing Agent, Stanton Yellowknife Hospital, Yellowknife, July 1973.

[13] "Hay River - Transportation Hub of the North," Alberta Business Journal, Edmonton , July-August, 1970, p. 68.

[14] This is also indicated by the high tonnage and ton-miles of freight per capita delivered by motor carrier to Hay River. (Also, see Chapter 4, p. for a discussion of the tractor-trailer ratio for Hay River.)

[15] The service to these communities varies from year-to-year and usually depends upon which company is awarded a carrier contract by the Hudson's Bay Company. In 1973, Pacific Western Trucking was the principal carrier to Rae, Edzo and Fort Resolution.

[16] See the discussion in Chapter 4, pp. 101-103.

[17] McCarty, Ibid., p. 157.

[18] See Table 15, and Figures 1-4 in Appendix F.

[19] That is, including the Giant Yellowknife Mines and Con Mines (Yellowknife), and Pine Point Mines (Pine Point).

[20] L. S. Bourne, "The Urban and Regional Economy of Yellowknife, N. W. T." (unpublished Master's thesis, University of Alberta, 1963), p. 95.

[21] Although these shipments are recorded as being delivered to aviation industry clients, it should be emphasized that most northbound truck shipments delivered to air transport clients are transhipped by air (from trucks) to mineral operations and exploration camps. Air transport operators are really acting as expeditors.

[22] This is obviously more practical for mining and exploration firms, since they often rely upon the same suppliers and can accurately determine long-term supply requirements.

[23] That is, for heavy or bulky shipments not suited to aircraft transport, and when cost constraints dictate the use of more competitive modes.

[24] Standard deviations calculated for the average size of northbound shipments are given in Appendix G .

[25] See Chapter 1, pp. 8-10.

[26] D. Schweitzer, Northern Canada Transportation Study (Regina: University of Saskatchewan, 1970), passim.

[27] Schweitzer, *loc. cit.*

[28] That is, "Not Otherwise Indicated by Name" (NOIBN).

[29] Mainly to the Northern Transportation Company Limited, but also to Kap's Transport and a few small Mackenzie water transportation operations.

[30] Bulk shipments to Cominco in Pine Point are all made by the Great Slave Lake Railway.

[31] See Chapter 6, pp. 185-187.

[32] One northern carrier client in Yellowknife estimates that his firm spends about 200% more on packaging and handling than his southern counterparts. Pers. interview, L. B. Duff, Manager, Nor-west Automotive, Yellowknife, July 1973.

[33] For example, empty compressed gas cylinders, food and beverage shipping containers, fuel and oil drums, etc.

[34] Pers. communication, Victor Allen, Secretary-treasurer, Village of Pine Point, 14 May 1973.

[35] From information gathered during this study, indications are that the volume of southbound traffic may be closer to 15% of the northbound volume.

[36] The Federation of Native Cooperatives, based in Yellowknife, manages the transportation requirements for several groups of native artisans in the Western Arctic. About 70% (70-80 tons) of the Co-op's southbound shipments are handled by truck from Yellowknife. Pers. interview, C. Gauthier, General Manager, Fed. of Native Cooperatives, Yellowknife, July 1973.

[37] Approximately 400 tons of frozen or refrigerated fish were discharged from the Freshwater Fish Marketing Corporation in Hay River in 1972. About 95% of the total southbound volume was handled by motor carrier. Pers. communication, G. Helmer, General Manager, Freshwater Fish Marketing Corp., Hay River, August, 1972.

[38] The high average content weight of southbound shipments for the mineral producing and construction industries reflect the large volume of trade-in construction equipment, heavy core parts (e.g., exchange crusher cones), and ore concentrates (from Echo Bay and Terra Mining via Hay River or Fort Rae, depending upon the season) discharged by these business functions.

[39] That is, one ton carried one mile. For a more thorough discussion of the advantages and disadvantages of ton-mile statistics, the reader should see: K. W. Studnicki - Gizbert, Methodology of Transport Statistics (Toronto: University of Toronto, 1970).

[40] Norton, Ibid., p. 100.

[41] Based on data in Table 26.

[42] Regional air carriers operating in the area (e.g., Pacific Western Airlines) supply only ton-mile statistics on their northern freight operations.

[43] Other important centres for northern motor carrier shipping include Peace River, Grande Prairie (3-4% total nbd. traffic volume), Calgary (possibly 5%), Vancouver (less than 2%), Regina, Winnipeg, and other points in Canada (2%), and U. S. points (less than 2%).

[44] Linear correlation coefficient R = 0.7.

[45] Especially if consideration is also given to the relationship between traffic volume and the number and type of business functions located in each settlement or centre.

[46] As defined in Chapter 1, p. 9.

CHAPTER 6

INTERMODAL FREIGHT MOVEMENTS AND COMPETITION

> *Accounting for the location of modern transportation always involves contemplation of the totality of traffic flows and systems that have been devised to accommodate them. ...Even though the research has only one part of the system under observation, the forming of valid hypotheses will probably require that the entire system be kept in mind.*[1]

When the total transportation requirements and traffic volumes handled by all transport modes in the Mackenzie Valley are considered, the relative position of the motor carrier in the area can be better appreciated. Air and water carriers contribute significantly to the total distribution of commodities and resource-products in the Valley, especially for communities and operations inaccessible by conventional ground transport. Intermodal shipments (between different carrier modes) are important in the Valley, and major transshipment operations have developed at locations on the highway network at Hay River, Yellowknife, and Fort Simpson. Concentration of transshipment services in a few locations facilitates the intermodal movement of traffic between air, rail, water, and motor carriers.

Water Transportation Operations

Water transportation operations in the Mackenzie Valley are based in Hay River, where the major terminals of the Northern Transportation Company (NTCL), and Kap's Transport are located. NTCL, Kap's, and a few smaller operators supply barging services to communities located on the Mackenzie River system (Figure 3), and the Western Arctic. During the 1972 shipping season, about 550,000 tons[2] of general and bulk freight were handled on the Mackenzie River system. Almost 400,000 tons[3] of the total was carried on NTCL barges (Appendix H).

The Mackenzie barging operations depend upon rail and motor carrier services to assemble barge traffic at Hay River, and to a limited extent, at Fort Simpson (Lindberg Transport -- now Arctic Navigation[4]). More than eighty-five per cent[5] of the total traffic volume on the Mackenzie water system is delivered to Hay River via the Great Slave Lake Railway (GSLR). Only perishable products and special shipments are delivered for transshipment to barge at Hay River by motor carrier.[6] However, motor carrier services are essential to the efficient and economic operation of the water transportation systems. The flexibility of motor carrier operations enables barge operators to compensate for unpredictable changes in shipping demands, and simplifies the logistic considerations made necessary by the short northern shipping season.

The significance of motor carrier services to water transport operations is emphasized by two recent corporate amalgamations. In July 1973, the Northern Transportation Company assumed controlling interest in the Grimshaw Trucking and Distribution Company "... as part of a programme to make more comprehensive and reliable transportation services available to NTCL clients."[7] The NTCL acquisition has resulted in the diversion of a large proportion of NTCL truck traffic away from competing motor carriers.[8]

In September 1973, H. M. Trimble and Son (the largest contract bulk carrier company in Canada), and Riv Tow Straits (a conglomeration of tug-and-barge operators based in Vancouver), purchased Lindberg Transport (Fort Simpson) as the first stage of a plan to develop the nucleus of a "total transportation" company in the Mackenzie Valley.[9] The new company, Arctic Navigation, is based on a good measure of optimism concerning the final outcome of the Mackenzie Valley pipeline proposals.[10] Drawing on the experience and technical capability of personnel at Trimac and Riv Tow Straits, Arctic Navigation will be able to supply reliable and competitive transportation services to pipeline contractors in the Mackenzie Valley. The coordination of contract water and surface transportation operations by one operator, should help to simplify the logistical considerations of material supply and distribution.[11]

Transshipment services provided by contract, off-highway carriers to transport barge shipments from distribution points on the Mackenzie River system, to remote mineral and hydrocarbon exploration operations are also very important, especially north of Fort Simpson. Due to environmental restrictions and strict government regulations,[12] many of these surface transportation operations must now be undertaken during the winter months when the ground is frozen and covered with a protective layer of compacted snow.[13] Some of the most important carriers who supply off-highway transshipment services to water transportation clients include, Pe-Ben Trucking (Norman Wells), Hanvold Expediting (Norman Wells and Inuvik), Kap's Transport (Hay River, Fort Simpson, Norman Wells, and Inuvik), Keen Industries[14] (Fort Nelson, B. C.), and Precambrian Mining Service (Yellowknife and Norman Wells).

Great Slave Lake Railway

The 432-mile Great Slave Lake Railway, which roughly parallels the Mackenzie Highway (Figure 6), connects Hay River and Pine Point with the Northern Alberta Railway at Roma, Alberta, just west of Peace River town. Owned and operated by Canadian National Railways, the

GSLR was completed in 1966 to provide an economical means of transporting base-metal (lead-zinc) concentrates from Pine Point Mines to the Cominco smelters ar Trail, British Columbia. In 1969, more than one million tons of freight were moved on the line.[15] Over seventy-five per cent of the total traffic volume was southbound and consisted mainly of mine production (85-90%)[16] and lumber products (about 5%).[17] Since 1969, the proportion of northbound traffic to total traffic has increased substantially.[18]

The volume of traffic handled on GSLR varies from year-to-year, and seems to reflect the general level of resource exploration in the Mackenzie Valley. However, the nature of the commodity traffic carried each year does not change significantly. Petroleum products represent about seventy-five per cent of northbound shipments handled each year. Non-perishable food shipments, and construction materials, including bulk cement, processed lumber products, iron and steel, and machinery are other regularly handled northbound commodities.[19]

Over 90,000 tons of general freight and bulk shipments were delivered on the GSLR to barge operators based in Hay River during 1969.[20] The total volume of northbound intermodal traffic (rail-barge) handled on the railway has increased by approximately thirty per cent each year since 1969. In 1972, more than 108,000 tons of bulk products (fuels, drilling compounds, cement, etc.), and approximately 65,000 tons of general freight[21] were delivered to NTCL and other barge transport terminals in Hay River, for transshipment (by barge) to clients located in the Mackenzie Valley and the Western Arctic.

Competition for freight traffic between northern motor carriers and the railway has never really developed in the Valley for a number of reasons. The Great Slave Lake Railway accepts only car-load shipments (usually a minimum of 30 tons), and due to the nature of southbound traffic handled, discourages the development of permanent northbound traffic which would require the acquisition of special rolling-stock or handling equipment. Since the only railway terminals in the Mackenzie Valley north of the sixtieth parallel, are located at Hay River and Pine Point, transshipment to motor carrier or aircraft is necessary for shipments to other centres on the existing highway network. For most clients, any savings in transport costs made by using rail services are lost when unloading, storage, reloading, and transshipment costs are considered. Railways do not offer the same advantages of portal-to-portal delivery, provided by motor carrier, and the incidence of pilferage, loss, or damage due to mishandling tends to be higher on rail shipments.

The most significant intermodal traffic generated for motor carriers by the development of the Great Slave Lake Railway is based on bulk petroleum distribution from storage terminals located in Hay River. In 1972, more than 20,000 tons[22] of bulk petroleum products were transshipped by motor carrier from rail-side storage facilities in Hay River to petroleum dealers in Fort Smith, Yellowknife, and to other locations on the territorial highway network. On a tonnage basis,[23] the volume of motor carrier traffic generated by the intra-regional[24] transshipment and distribution of petroleum products is almost equal to the total volume of motor carrier traffic entering the Mackenzie Valley Area (Tables 20 and 21).

Truck-Air Shipping

The major air carrier operating in the Mackenzie Valley is Pacific Western Airlines (PWA). Between 1968 and 1972, the total volume of air freight carried by PWA to destinations in the Mackenzie Valley increased by more than forty-five per cent each year.[25] In 1969, PWA accounted for over ninety per cent of the total ton-miles of air freight traffic handled by all carriers in the Valley.[26] Since 1969, Pacific Western's share of total air cargo has increased relative to its competitors each year.[27] Pacific Western's success is due, at least in part, to the adoption of innovative transport systems and equipment, specifically designed to meet northern transportation requirements.

Pacific Western Airlines pioneered the development of scheduled container-jet shipping in the North, and was the first Canadian airline to utilize Hercules (Lockheed C-130) freight aircraft. In addition, "truck-air"[28] services -- which are now only provided on a contract basis -- were developed by PWA in the late 1960's to provide more competitive air transport services to large-volume shippers in the northern exploration and resource development industries (Plate 8). The principal advantages of the truck-air service include significant reductions in transport costs and the time required to transship an equivalent volume of freight by conventional air freight equipment. Both the truck-air and container-jet services are designed to complement the northern trucking services of Pacific Western's Trucking Division, and to allow the integration of air and ground capability to meet individual service requirements inexpensively. In 1969, approximately 1100 tons[29] of cargo were delivered to destinations in the Mackenzie Valley through the coordination of PWA's trucking and air freight services.[30]

Today, efforts are being made to discourage the use of Hercules truck-air services to scheduled-run destinations in the Mackenzie Valley. Boeing 727f jet aircraft, designed to carry eight containers (called "igloos") for a

Plate 8. Hercules aircraft in flight. The Hercules cargo aircraft has been widely used and accepted in the Canadian North for the rapid movement of heavy, bulky payloads to remote oil drilling and mineral exploration sites.

total payload of up to 40,000 pounds,[31] were put into service in 1971 and have absorbed a large proportion of air traffic formerly handled by Hercules aircraft. Rapid acceptance[32] of the more competitive container service has allowed the truck-air operation to concentrate on the special requirements of the exploration industry. Truck-air freight services are now limited to the movement of heavy or large dimension shipments to isolated locations with poor runway facilities. Bulky, heavy, or odd-sized shipments are usually trucked to northern staging areas in Yellowknife, Hay River, or Fort Simpson, where the trailer and contents may be transshipped by aircraft.

Competition Between Modes

At the present time, there is only limited potential for active competition for traffic between the various carrier modes in the Mackenzie Valley. Even for transportation clients at locations served by several modes, the selection of the most suitable and economic carrier alternative is made "... on the basis of the suitability of the carrier to the commodities ... being ... shipped."[33] Especially in the North, the quality of service received from any carrier is more important than the transportation rate paid.

It is unlikely that the rail and water carriers' share of traffic in the Valley will be seriously affected by future highway developments.[34] Both rail and water carriers concentrate on the long-distance movement of heavy, large volume, bulk shipments[35] (for a few clients) not suited to highway or air transport. Due to high fixed costs[36] in equipment, terminals, and other related facilities, rail and water carriers have only a very limited ability to accept less-than-carload traffic and small, piece-lot shipments. In the next decade, technological improvements in the container and "piggy-back"[37] handling systems may help to increase the ability of northern rail and water carriers to handle small, mixed-cargo shipments competitively. However, for the rapid movement of perishables, or high-value-to-weight commodities, truck and air carriers will maintain a strong competitive position.

We can conclude that the relationship between the various northern transport modes is highly complementary, rather than strictly competitive. The intermodal transshipment of traffic at various locations in the Valley reflects geographic limitations and the elementary character of the northern transportation network. Intermodal shipping is a geographic necessity rather than an economic option for many transportation clients in the Mackenzie Valley Area. In other words, as Purdy has put it:

> *There is .... a distinctive demand*

> *and supply situation for each carrier for each commodity (or groups of commodities) in different areas and for varying lengths of haul.*[38]

CHAPTER 6

FOOTNOTES

[1] H. McCarthy, and J. Lindberg, Economic Geography (Englewood Cliffs: Prentice-Hall, 1966), p. 163.

[2] Pers. interview, D. S. Robinson, Traffic Manager, Northern Transportation Company Limited, Edmonton, 10 October 1973.

[3] Robinson, Ibid.

[4] Lindberg Transport was sold in September 1973 to a new consortium of transportation companies called, Arctic Navigation. Major shareholders in Arctic Navigation include Trimac (Calgary), and Riv Tow Straits (Vancouver).

[5] Robinson, op. cit.

[6] NTCL also operates several cargo aircraft (DC3, DC4, and Otter), to meet emergency and special shipping requirements.

[7] Robinson, loc. cit.

[8] Pers. interview, R. S. Small, Traffic Director, Pacific Western Trucking Division, Edmonton, 18 September 1973.

[9] Pers. communication, D. S. Vincent, Manager Sales and Services, Trimac Transportation System, Calgary, 15 January 1974.

[10] Edmonton Journal, 30 October 1973, p. 41.

[11] Pers. interview, J. R. O'Rourke, Pipeline Logistics Planning, Canadian National Railways, Edmonton, 22 May 1973.

[12] To minimize damage to the local environment, especially in zones of permafrost.

[13] Williams Brothers Engineering (Calgary) is developing a snow-making machine mounted on a large all-terrain vehicle for use in the North. If successful, the machine would allow an earlier opening of winter road operations. A prototype was tested in December 1973, near Inuvik.

[14] Keen Industries is a conglomerate of ten northern companies which offers total transportation services in northern Alberta, British Columbia, and the Painted Mountain - Fort Liard area of the Northwest Territories.

[15] M. Marsden, "Transportation in the Canadian North," The North, edited by W. C. Wonders (Toronto: University of Toronto, 1973), C. 3, p. 57.

[16] Marsden, Ibid.

[17] Pers. communication, W. J. Dewan, Public Relations Manager, CNR, Edmonton, 26 November 1973.

[18] Pers. communication, G. H. Graham, Superintendent, GSLR, Peace River, 16 November 1973.

[19] Dewan, op. cit.

[20] Marsden, loc. cit.

[21] Robinson, NTCL, 10 October 1973.

[22] Pers. communication, I. G. Shaw, Industrial Marketing, Gulf Oil Canada, Calgary, 12 October 1973; Argue Transport, and Joe Klone's Limited (both Hay River).

[23] But not on a ton-mile basis.

[24] That is, between communities and operations within the Mackenzie Valley area.

[25] Pacific Western Airlines, Annual Report - 1972, p. 11.

[26] J. L. Courtney, Northern Air Transport Study (Toronto: CTC, 1971), Report 7118, p. 20.

[27] Pers. interview, A. H. Plunkett, Northern Operations, PWA, Edmonton, 11 October 1973.

[28] The Hercules C-130 is often called the "workhorse of the Arctic" because it has a range of up to 2,000 miles with a full payload of 44,000 pounds. The C-130 can take off in shorter distances than any other heavy cargo air-

craft and is capable of landing on gravel runways and ice. The term "truck-air" developed when the Hercules service was inaugurated -- loaded semi-trailers up to 14.5 feet high, 45 feet long, and 9 feet wide can be accommodated in the C-130 cargo compartment.

[29] Courtney, op. cit., p. 71.

[30] Considering "truck-air" and general freight shipments together, PWA delivered about 6500 tons of cargo to locations in the Mackenzie Valley during 1969. Plunkett, op. cit., 30 August 1973.

[31] Depending upon the distance carried -- cargo capacity is sacrificed for fuel as the distance increases.

[32] For example, in 1971, when the container-jet service was started, two trips per week were scheduled to Inuvik. In 1973, there were five scheduled and one contract (Gulf Oil 737 b) container-jet flights to Inuvik each month and an additional scheduled run is planned in 1974. Pers. interview, D. Shinnan, Station Manager, PWA, Inuvik, 6 December 1973.

[33] H. L. Purdy, Transport Competition and Public Policy in Canada (Vancouver, University of British Columbia, 1972), p. 72, citing J. S. Gray, "Selection of Transportation Services" (unpublished Master's thesis, U.B.C., 1969).

[34] J. R. O'Rourke, "Logistics Planning for a Northern Pipeline," The Journal of Canadian Petroleum Technology (July - September, 1971), pp. 1-6.

[35] In 1972, more than 60% of the total volume of traffic handled by NTCL on the Mackenzie River system consisted of liquid and dry bulk commodities (petroleum products, cement, drilling mud, etc.). Robinson, loc. cit.

[36] About 40% of rail and water carriers operating costs are fixed, but less than 10% of total operating costs for motor carriers are fixed. H. L. Purdy, Ibid., /p. 79.

[37] NTCL has experimented with container "piggy-back" (trailer-on-flatcar -- TOFC), and even "fishy-back (trailer-on-barge) shipping systems in recent years, to reduce handling costs and claims due to damage, pilferage, and loss. Robinson, loc. cit. The results of these early trials have not been fully evaluated yet.

[38] Purdy, op. cit., p. 91.

CHAPTER 7

FUTURE PROSPECTS

> *Great care must be taken that traditional methods of solving transport problems are not followed blindly without given due consideration to the great weight of a very rapidly changing transportation technology.*[1]

Development of the Highway Network

Northern motor carrier operators have a fundamental interest in the development and improvement of the Mackenzie Valley highway network. Extensions of the existing network would connect isolated communities and operations served only by air, water, or winter-road to-day, and open new markets to the highway trucker. Improvement of existing facilities, such as surfacing of the Mackenzie and Yellowknife Highways, or the construction of a bridge at the Fort Providence crossing,[2] would substantially reduce line-haul operating costs and improve the quality of service provided to northern motor carrier clients.

In the past few years, "eco-power"[3] has set the pace for northern highway development. Environmentalists and scientists from almost every discipline have studied

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the physical, economic, social, and cultural consequences of northern road construction. As a result of their efforts, we are in a better position to-day to assess the "total impact" of projects such as the Mackenzie and Dempster Highways on the northern human and physical environment, than at any other period in history, for any similar projects (e.g., Alaska Highway). However, northern development planners must not allow their concern for the potential environmental hazards of highway construction to overshadow the economic and social advantages creation of all-weather surface access can mean in the Mackenzie Valley. To do so could result in:

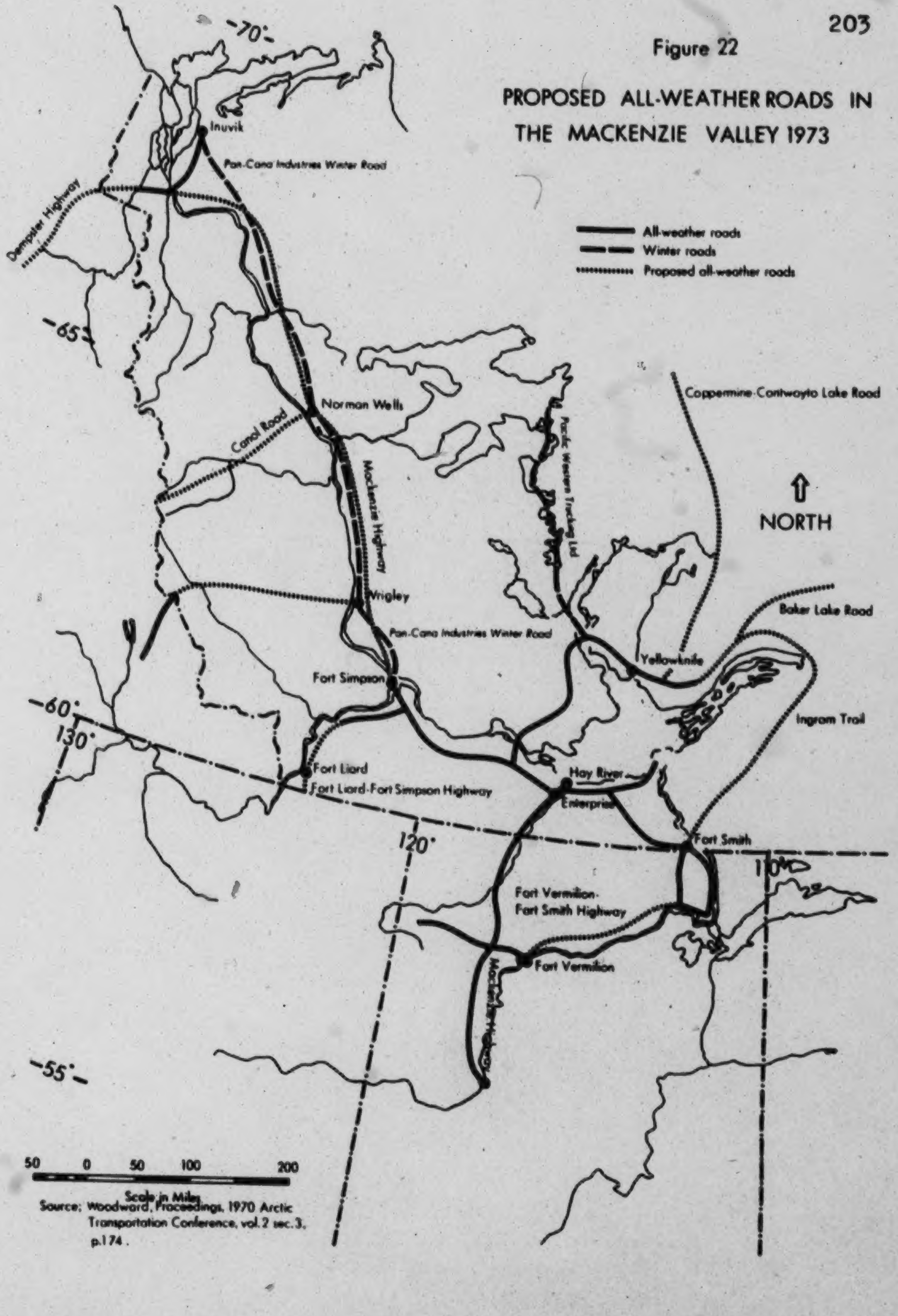
> *... the premature hardening of the system in the wrong places ... and would ... hinder northern development through the misapplication of development capital and imposing higher transportation costs upon subsequent development than necessary.*[4]

Despite tremendous increases in the cost of fuel,[5] labour,[6] and replacement equipment,[7] which are expected in the motor carrier industry in the next few years, truck transport will likely remain the most economical mode of shipping[8] in the Mackenzie Valley for some time. Connection of settlements along the Mackenzie River to the territorial highway system would not only break the isolation of these communities,[9] but would significantly reduce the disadvantages of high shipping costs and poor communications. As well, extension of the Mackenzie Highway, north of Camsell Bend to Inuvik will likely provide a stimulus to exploration and development firms to push arterial roads into the foothills and mountain zones of the Northwest Territories, much as the Alaska Highway has in the Yukon.

One of the major economic advantages of secondary arterial route development in the Mackenzie Valley would be the creation of circle routes. As the number of circuitous routes increases in a transport system the efficiency and economy of transportation to each point (settlement or client) in the system is improved.[10] Construction of connecting links between the Mackenzie, Dempster, Yellowknife, and Alaska Highways (Figure 22), would facilitate the movement of traffic between the Mackenzie Valley, and remote areas of the Yukon or the northern regions of British Columbia, Alberta, and Saskatchewan. More options will exist for motor carriers to make minor route changes in an effort to secure revenue traffic on the backhaul. Further, the potential to increase tourist traffic in the Territories should not be underestimated.[11]

Figure 22

PROPOSED ALL-WEATHER ROADS IN THE MACKENZIE VALLEY 1973


All-weather roads
Winter roads
Proposed all-weather roads
70°
65°
60°
55°
130°
120°
110°
Inuvik
Pan-Cana Industries Winter Road
Dempster Highway
Norman Wells
Canol Road
Mackenzie Highway
Wrigley
Pan-Cana Industries Winter Road
Fort Simpson
Fort Liard
Fort Liard-Fort Simpson Highway
Pacific Western Trucking Ltd
Coppermine-Contwoyto Lake Road
NORTH
Baker Lake Road
Yellowknife
Ingram Trail
Hay River
Enterprise
Fort Smith
Fort Vermilion-Fort Smith Highway
Fort Vermilion
Mackenzie Highway
50
0
50
100
200
Scale in Miles

Source; Woodward, Proceedings, 1970 Arctic Transportation Conference, vol.2 sec.3, p.174.

Facility User-Charges

In Canada, road transportation facilities are generally regarded as "pure public goods." According to Samuelson, a pure public good is one:

> *... which all enjoy in common in the sense that each individual's consumption of such good leads to no subtraction from any other individual's consumption of that good.*[12]

However, as Haritos has pointed out, to regard our highways as pure public goods may not be entirely realistic, especially since roads are not equally available to all, but are "... available only to the vehicle owners and operators ..."[13] On this basis, it has been suggested that in the long run "... there is no reason for transportation facilities to be publicly financed."[14] Since every vehicle journey imposes measurable costs on the highway system, maintenance[15] and administration expenses[16] for the public facility should be recovered, either through licensing and fuel taxes, or by toll charges.

In southern Canada, where the per capita cost of transportation facilities is low and the revenue base is very large, the need for government subsidization of public transportation facilities is not so vital as in northern Canada. In the North, the population and revenue bases are both small relative to regional requirements.

TABLE 27

FEDERAL GOVERNMENT EXPENDITURES AND REVENUES RELATED TO ROADS IN THE NORTHWEST TERRITORIES, 1965-1970

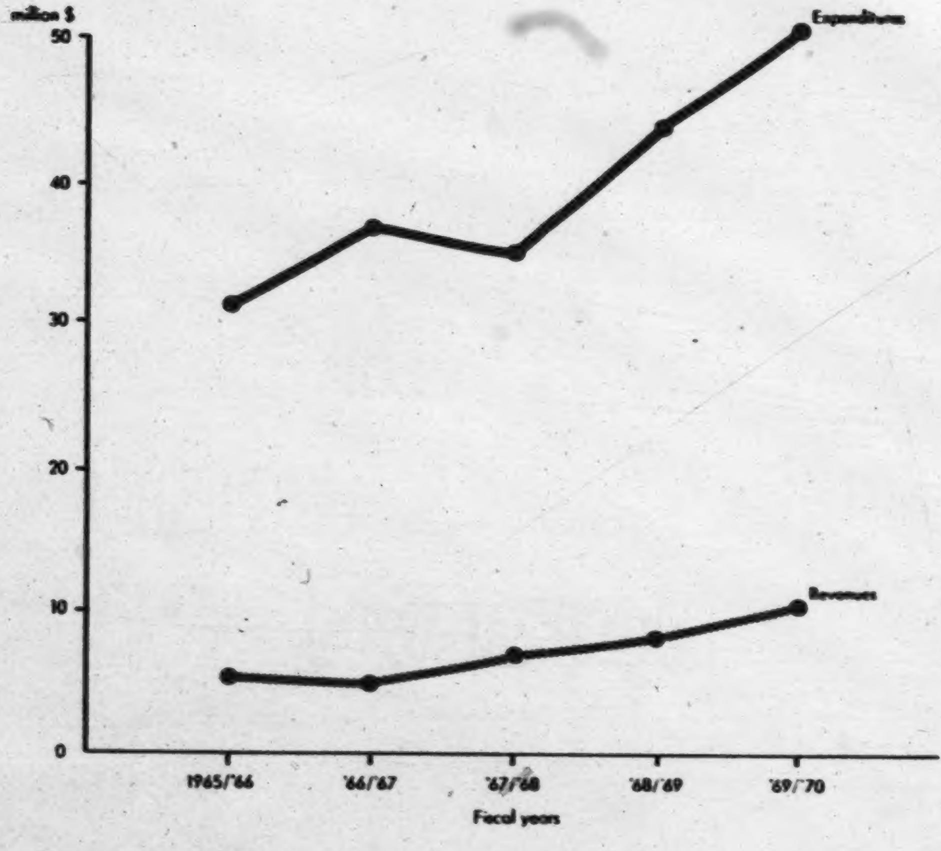
($000's)

Expenditures	1965/66	66/67	67/68	68/69	69/70	Totals
Capital	1,560	4,004	2,609	3,097	4,290	15,560
Operations maintenance	439	295	888	604	676	2,902
Totals	1,999	4,299	3,497	3,701	4,966	18,462
Revenues						
Fuel tax	294	370	405	609	690	2,368
Motor Vehicle Licenses	85	106	116	175	197	679
Totals	379	476	521	784	887	3,047

Source: I. C. Cornblat, "Facility Costs and User Charges," in Proceedings, Arctic Transportation Conference, Yellowknife, 1970, vol. 3, sec. 2, pp. 80-81.

Figure 23

FEDERAL GOVERNMENT EXPENDITURES AND REVENUES
RELATED TO TRANSPORTATION IN THE NORTH
1965-1970



Source: I.C. Cornblat, "Facility Costs and User Charges," in Proceedings, 1970 Arctic Transportation Conference, vol. 3 sec. 2, p. 73

In addition, unique physical conditions contribute to abnormally high road construction and maintenance costs. A large discrepancy exists between the cost of providing northern surface transport facilities, and the revenue generated from fuel taxes, and licensing (user-charges) in the Territories[17] (Figure 23). Federal government subsidization through the "Roads-to-Resources" and the "Northern-Roads" assistance programmes has fostered the development and improvement of territorial roads, at minimum expense to local governments and northern facility-users. The long-range economic viability of the northern motor carrier industry, and therefore, the quality of transport service provided to northern business and industry could be threatened if full recovery user-charges are imposed.

CHAPTER 7

FOOTNOTES

[1] P. M. Manders, "A Rational Approach to Transport Planning for the North" (a paper presented to the Canadian Good Roads Association, 8 October 1970, Montreal), p. 17.

[2] Northern residents have agitated for a bridge crossing at Fort Providence for several years. Construction of a bridge would provide all-season access to Yellowknife, eliminate the Mackenzie ferry operation, and reduce transportation costs, especially during spring break-up and winter freeze-up. However, a study commissioned by the Federal Government in 1971 concluded the bridge crossing was not economically justified. P. M. Manders and H. Weissenberger, The Fort Providence Bridge Study (Ottawa: DIAND, 1971).

[3] Financial Post, 1 September 1973, p. 19.

[4] G. Rogers, "Alaska," North, vol. XVL, no. 3 (May - June, 1969), p. 37.

[5] Financial Post, 29 December 1973, p. 1.

[6] Financial Post, 8 December 1973, p. 42.

[7] Financial Post, 23 June 1973, p. 4.

[8] That is for small volume shipments (less than 20 tons), and heterogeneous (mixed-cargo) shipments.

[9] Some communities, such as Wrigley, have protested the construction of the Mackenzie Highway, and have demanded that the route selected avoid the settlement by at least twenty miles. News of the North, Yellowknife , 3 October 1973, p. 30.

[10] K. J. Kansky, Structure of Transportation Networks (Chicago: University of Chicago, 1963), and C. C. Kissling, "Linkage Importance in a Regional Highway Network," Canadian Geographer, vol. XIII, no. 2, 1969, pp. 113-127.

[11] Travacon Research Limited, *Economic Study of Transportation in the Mackenzie Valley* (Edmonton, Travacon, 1973), passism.

[12] P. A. Samuelson, "The Pure Theory of Public Expenditure," *Review of Economics and Statistics*, November, 1954, p. 387.

[13] Z. Haritos, *A Pricing Policy for Public Transportation Facilities* (Ottawa: CTC, 1971), Report 15, p. 20.

[14] Haritos, *Ibid.*, p. 21.

[15] The general philosophy of user-charges is to recover only operating costs required to maintain the road at original standards, but not construction costs.

[16] One economist has suggested that "... social costs somehow allocated" should be included in user-charges, particularly in northern Canada. E. T. Haefele, "Transport Facility Costs and User Charges," in *Proceedings*, Arctic Transportation Conference, vol. 3, *sec. 2, 1970*, p. 87.

[17] The Travacon Study (1973) concludes that "optimistically" fuel tax revenues will increase by "...not more than $113,000 by 1980 of which only $28,000 would be derived from use of resident automobiles." Travacon, *Ibid.*, p. 10. In 1970 revenues from fuel tax and licenses in the Northwest Territories amounted to less than $890,000. More than $4,200,000 was spent on road development, and $676,000 on maintenance. I. C. Cornblat, "Facility Costs and User Charges," in *Proceedings*, Arctic Transportation Conference, vol. 3, sec. *2, 1970*, pp. 80-81.

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CHAPTER 8

CONCLUSIONS

During the 1972 operating season,[1] more than 108,000 tons[2] of freight were carried by common, contract and supplier[2] carriers to clients located in the Mackenzie Valley area.[3] Although the motor carriers' share of the total volume of freight traffic handled by all transport modes in the Valley was less than ten per cent during the 1972 season (Table 28), motor carriers provided an essential means of economical freight transport for communities on the Mackenzie and Yellowknife Highway network. As the northern highway system is extended to connect presently isolated settlements and resource operations, truck transport services will help to reduce shipping charges, improve communications, and make a greater variety of commodities available at reasonable cost (e.g., fresh produce, meats, and other perishables). Motor carrier services, based on secondary arterial road development and winter road operations, will continue to facilitate the rational economic development of mineral reserves, much as the Pacific Western winter road operation has for silver properties on Great Bear Lake.

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TABLE 28

TOTAL VOLUME OF SHIPMENTS HANDLED BY ALL CARRIER MODES IN THE MACKENZIE VALLEY AREA
1972

Carrier Mode	Ton-miles of freight traffic handled
Rail transport	350,000,000[a]
Water transport	210,000,000[b]
Air transport	32,000,000[c]
Motor transport	78,000,000[d]
Total all modes	870,000,000

Sources and Notes:

[a] Approximate only, pers. communication, W. J. Dewan, Public Relations Manager, CNR, Edmonton, 26 November 1973.

[b] Approximate only, pers. interview, D. S. Robinson, Traffic Manager, Northern Transportation Company, Edmonton, October 1973.

[c] J. L. Courtney, Northern Air Transport Study (Ottawa: CTC, 1971), and A. H. Plunkett, PWA, pers. interview, October 1973.

[d] See Table 26.

An analysis of typical line-haul operating costs for northern motor carriers demonstrates that line-haul costs for northern carriers average at least fifteen to twenty per cent[4] higher than similar costs incurred on southern Canadian operations. However, the average operating ratio, and therefore, revenue generation is higher for northern carriers. Considering the unique difficulties of northern operation, and the vulnerability of demand for carrier services on some routes to short-term changes in the level of mineral or hydrocarbon exploration, northern motor carriers may be entitled to an equal rate-of-return on their investments. Over the long-term, if operating ratios remain high, stricter controls governing the level of freight rate increases, and changes in the nature of trucking services offered[5] should be instituted.

At the present time, the relationship between the various carrier modes operating in the Valley is complementary rather than competitive. The efficient and economical distribution of many commodities (particularly bulk supplies) depends upon the intermodal movement of traffic on a cooperative basis. This pattern is not likely to change for some time in the forseeable future. Over much longer periods, the degree of competition for traffic between air and motor carriers may become significant, especially if operating costs in the motor carrier industry continue to rise exponentially, and if technological advancements in the aircraft industry (in particular, more versatile freighter versions of the Boeing 747, or the Lockheed L-1011) are realized.

One of the major problems encountered during this study was the location and acquisition of reliable data sources. The high return[6] which was achieved from the questionnaire and interview survey was due, in large part, to the sympathetic cooperation of northern motor transport clients, and a few key personnel in the northern motor transport industry. A tremendous effort is required on the part of northern motor carrier operators to up-grade the industry's image and liaison with their customers, and the public as a whole. Immediate steps should be taken to establish a motor transport association in the Northwest Territories as the first stage in a programme to develop professionalism in the northern motor transport industry. The Alberta Motor Transport Association would likely find it in the best interests of its members to encourage the growth of an affiliated organization in the Northwest Territories.

The Highway Traffic Board of the Territorial Government has an immediate responsibility to the established motor carrier operators in the Mackenzie Valley to address itself to the problems of excessive competition between motor carriers in the Northwest Territories. Rate-cutting, which will ultimately lead to a reduction in the number of reliable carriers and the quality of service in the Valley, has resulted because of the Boards' "laissez-faire" policy towards the issuance of operating authorities. New regulations controlling the number and type of operating authorities should be developed, based perhaps, on quota or provision of service[7] guidelines.

It is impossible to consider all of the changes which are necessary or desirable in the northern motor carrier industry in the limited space available. One conclusion is inescapable. Truck transportation has provided an absolutely indispensable service to business and industry in the Mackenzie Valley during the last half century. Motor carriers provide the only economic transportation alternative for small volume clients at many locations in the Valley. In the next decade, government agencies have a fundamental and obvious responsibility to provide the legislation and assistance which is necessary to ensure the integrity and long-range economic viability of motor carrier operations in the Mackenzie Valley.

The data-base and analysis presented in this study should help to establish a statistical frame-work for subsequent northern transportation studies. More specifically, the information may provide a reliable basis to evaluate and improve models designed to forecast future transportation demands in the study area.

Numerous individual studies have provided descriptions of northern air, rail, or water carrier operations, however, future research should concentrate on a comprehensive analysis of the various carrier modes as interrelated sub-systems of the overall transportation network in the Mackenzie Valley. The long-range growth and development of the northern motor carrier industry will not only be determined by the extension of the northern highway system, but also by the changing competitive position of alternate carrier modes.

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CHAPTER 8

FOOTNOTES

[1] See Chapter 1, p. 9.

[2] See Chapter 5, pp. 153-154.

[3] Defined in Chapter 1, "The Setting," pp. 11-22.

[4] See Chapter 4, pp. 111-117.

[5] For example, minimum volume rates equal to hundredweight class 100 rates were adopted by several common carriers in the Mackenzie Valley in 1973, without any prior notification to the Northwest Territories Highway Traffic Board or motor carrier clients.

[6] Approximately 50% of the data was compiled from questionnaire data and 30% was obtained from interview information. Chapter 5, pp. 136-137.

[7] Operating authorities should be granted when the provision of service by the applying carrier will result in an improvement in the quality of service within a specific area, or mean the development of trucking services to areas formerly by-passed or inaccessible.

Plate 9. Winter-road operation, Hardisty Lake, N. W. T., March 1973. Winter road operations, such as the Echo Bay-to-Edzo run, have helped to assure the economic viability of several remote mineral operations in the Mackenzie Valley. Coordinated with existing all-weather trucking operations, off-highway trucking will continue to provide a valuable and competitive transportation alternative for many motor clients in the future.

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APPENDIX A

Definition of Terms

DEFINITION OF TERMS

CLASS RATE -- Most freight shipments handled by common carriers move under class rates. The motor transport rate classification used in Canada to-day is patterned after the original railway rate classification system. Commodities are classified on the basis of the difficulties involved in transporting and handling each commodity shipment. The class rate scale used by northern common carrier operators range from Class 55 (low) to Class 100 (high). Very difficult to handle shipments are classified as multiples of Class 100 (e.g., explosives--Class 200, radial engine aircraft--Class 400). Less-than-truckload (LTL) shipments (usually less than 10,000 lbs.) move by Class 100 rates unless otherwise specified.

COMMODITY RATE -- Commodity rates are sometimes offered by contract carriers on an agreed basis for regular, truckload, homogeneous shipments (e.g., farm machinery, grain, cement, or bulk petroleum products). These rates are almost always lower than the lowest class rates for truckload shipments.

COMMON CARRIER -- Motor transport firms who hold themselves out to the general public to engage in the transport of property over regular or irregular routes.

CONTRACT CARRIER -- Motor transport firms under continuing contracts with one or a limited number of persons or firms, either for the furnishing of transportation services for the exclusive use of each person served or distinct services designed to meet the needs of various customers.

HOTSHOT --"Straights" or "Hotshots" provide rapid-light delivery services to oil drilling and exploration operations.

INDEPENDENT OPERATOR -- A contract carrier operator, usually with less than six units, who provides local distribution services under contract for a limited number of clients (e.g., Joe Klone's Ltd., Hay River -- bulk petroleum distribution).

INTERMODAL (TRANS)SHIPMENT -- An intermodal freight movement occurs when a freight shipment is handled by two (more than two--multimodal) carrier modes before final delivery.

MILEAGE-BASIS RATE -- A sliding rate offered on truckload shipments and determined by the distance from portal-to-portal. Mileage-basis rates are most commonly offered on long-distance contract hauls (e.g., mobile-homes or auto carriers).

MODE -- The type of carrier used. There are four principal carrier modes -- water, air, rail and surface (motor transport).

TRAFFIC -- Unless otherwise specified, "traffic" refers to that which is transported and is usually measured in tons or ton-miles. Where traffic "flows" are considered the movement of vehicle units over a specified time period is implied and is indicated as "vehicular traffic."

APPENDIX B

Client and Operator Questionnaires

David R. Podmore
DEPARTMENT OF GEOGRAPHY
TELEPHONE (403) 432-3274

THE UNIVERSITY OF ALBERTA
EDMONTON, CANADA T6G 2H4

Room 3-9 Tory Bldg.,
Summer 1973

NORTHERN TRUCK OPERATOR SURVEY

Dear Sir:

I am a graduate student at the University of Alberta, working on the thesis requirement of my master's degree in northern transportation geography.

My thesis will involve a comprehensive examination of existing all-weather and winter-road truck transportation services in Northern Alberta and the MacKenzie Valley. When completed this project will provide an up-to-date description of northern trucking operations, and will include an analysis of operating costs, the type and volume of goods transported, and the industries served.

An accurate assessment of the importance and trends in the northern trucking industry requires the collection of data from the various transport companies, owner-drivers, and contract operators who provide service to northern communities and industry. For this reason I would like to ask you to complete the attached questionnaire and return it in the self-addressed, postage-paid envelope.

This project carries the sanction of the territorial, provincial, and federal agencies. All information collected will be treated in the strictest confidence, and used for statistical purposes only.

With your cooperation this thesis will help to identify the factors which favour improvement of the northern road system, and the creation of better operating conditions in an extended market area for you, as a member of the northern transportation industry.

The results of this thesis will be available to any interested party at the address given above. I hope you will cooperate with me in this endeavor to provide a comprehensive analysis of the important role your industry is playing in the economic and social development of the MacKenzie Valley.

Copies of the final report will be presented to the Edmonton Chamber of Commerce, and concerned departments in the federal and territorial governments to assist them in improving conditions for northern trucking operations.

The results of this report, and subsequent action should benefit all members of the trucking industry and the customers served.

Transportation is the "vital key" to northern economic development. Decisions which affect the direction and nature of northern development must be based on an accurate interpretation of present trends and requirements.

Thank you for your time and cooperation.

Yours truly,

David R. Podmore

David R. Podmore

David R. Podmore
DEPARTMENT OF GEOGRAPHY
TELEPHONE (403) 432-3274

THE UNIVERSITY OF ALBERTA
EDMONTON, CANADA T6G 2H4

NORTHERN TRUCK OPERATOR SURVEY

Please complete the information below.

If there are any questions or difficulties I would be happy to offer any explanations or assistance you require.

(Edmonton 432-5626)

Company/Operator;____________________

Address;____________________ Phone;__________

____

Department or individual to address any future correspondence to;

____

____

1. Do you operate equipment in any of the following areas?
   Northern Alberta (i.e. North of Highway 16) ________
   Northern Saskatchewan (i.e. North of Highway 3)______
   Northwest Territories ____________________

2a. Where is your head office?____________________
 b. Where is your base of operations?____________________
 c. Where are your field offices located?____________________
____

3. What makes, type, and number of units do you operate?
   (e.g. Kenworth diesel tractors - 5, Willock low-bed trailers - 3, etc.) ____________________
____
____
____

4. What proportion (percent) of your tractors are;
   owned by your company ____________________
   leased from other companies____________________
   contracted from independent operators____________
   other (please specify) ____________________

5. What commodities are most commonly handled on NORTHBOUND shipments? (e.g. meats, food stuffs, equipment, etc.)
   Could you indicate also the relative importance of these commodities as a proportion (percent) of the Northbound freight volume you handle.

Commodity	Proportion of total freight volume (i.e. Northbound)

6. What commodities are most commonly handled on SOUTHBOUND shipments?
   Could you indicate the relative importance of these commodities as a proportion of the Southbound freight volume you handle.

Commodity	Proportion of total freight volume (i.e. Southbound)
________	________
________	________
________	________
________	________

7. What proportion of NORTHBOUND shipments originate at;

Edmonton________
Calgary ________
Other Alberta points________
____

the West Coast________
U.S.A. ________
other (specify) ________
____

8. What proportion of NORTHBOUND shipments terminate at;

Peace River ________
High Level ________
Hay River ________
Fort Simpson ________

Fort Rae } ________
Yellowknife }

Pine Point }
Ft. Smith } ________
Ft. Fitzgerald }

Other (specify)________
____

9. Where do your SOUTHBOUND shipments originate?

Source (e.g. company, mine site, etc.)	Location
________	________
________	________
________	________
________	________

10. What proportion of your SOUTHBOUND shipments terminate at;

Edmonton________
Calgary ________
Other Alberta points____
____

the West Coast ________
U.S.A. ________
Other (specify) ________
____

11. What proportion of your shipments would be comprised of trailer-load versus less-than-trailer-load shipments?

	Trailer-load	Less-than-trailer-load
NORTHBOUND	________	________
	Trailer-load	Less-than-trailer-load
SOUTHBOUND	________	________

12. What would be the average content weight per trip (1,000's lbs.) over the MacKenzie Highway and other northern routes?

Northbound ________

Southbound ________

13. Does the demand on your operation vary seasonally? If so how?

____
____

14. Could you provide a reliable estimate of the number of trips made per month, by your trucks on northern routes during 1972?

	No. of trips Northbound	No. of trips Southbound
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		

15. Do you operate on a regularly scheduled service basis, strictly contract, or both?

16. What proportion of the commodities you ship must move under special conditions? (e.g. temperature controlled vans)

17. Who are your four major customers in order of importance?

a.

b.

c.

d.

18. What is the average annual mileage incurred per tractor unit operating on the northern routes? ______ miles.

19a. Do you ever operate your units on "winter-road"* operations?

b. On a "winter-road"* operation do you work under an independent contract, mileage, hourly, or other lease arrangement?

c. On which "winter-road"* operation(s) have you operated your tractor(s)?

20. Do you find that "winter-road"* operation affects the service and maintenance costs or life-expectancy of your tractor-trailer units?

21. Could you provide information on your average line-haul operating costs per mile (or per month if you prefer) by classification as follows?

	Northern Routes	Winter-roads * (if applicable)
Driver's wages		
Fuel and oil		
Driver's Allowances		
Insurance		
Tractor maintenance		
Trailer maintenance		
Tires and tubes		
Other (specify)		

* That is, open for hauling only during winter months and built on snow or ice.

22a. Is the cost of special protective equipment for vehicles operating on winter-roads or the unpaved portion of the northern highways a significant item of expense?

____

b. If so what type of alteration or customizing is necessary?

____

____

23. What proportion of your shipments connect with barge transportation services at Hay River? ______________

24. What proportion of your shipments connect with air freight services at;

Hay River ____________

Yellowknife__________

other (specify)____________

25a. Would you consider 1972 a typical year based on the traffic volume for your operation? ______________________

____

b. Was it higher or lower than expected? ________________

c. Can you offer any explanation why the demand for northern trucking services increased/decreased in 1972? ____

____

____

____

26a. Are the services and regulations of the Department of Transport, territorial, and provincial government adequate and useful from a truck operator's viewpoint? ______________________

____

____

____

b. What changes are necessary? ____________________

____

____

____

c. What suggestions do you have for the future? ________

____

____

____

____

____

____

THANK YOU VERY MUCH FOR YOUR COOPERATION

DAVID R. PODMORE

David R. Podmore
DEPARTMENT OF GEOGRAPHY
TELEPHONE (403) [illegible]

THE UNIVERSITY OF ALBERTA
EDMONTON, CANADA [illegible]

Room 3-9 Tory Bldg.,
Summer 1973

NORTHERN TRUCK TRANSPORTATION CLIENT SURVEY

Dear Sir:

I am a graduate student at the University of Alberta, working on the thesis requirement of my master's degree in geography.

My thesis will involve a comprehensive examination of existing all-weather and winter-road truck transportation services in Northern Alberta and the MacKenzie Valley. When completed this thesis will provide an up-to-date description of northern trucking operations, and will include an analysis of operating costs, the type and volume of goods transported, and the industries served.

An accurate assessment of the importance and trends of the northern trucking industry requires the collection of data from the various transport companies and contract operators who provide service to northern communities and industry. However, the opinions and suggestions of individuals who use these northern trucking services is just as important to the development of a reliable account. With this in mind could you please complete the attached questionnaire and return it in the self-addressed, postage-paid envelope.

This project carries the sanction of federal, territorial and provincial agencies. All information collected will be treated in the strictest confidence and used for statistical purposes only.

With your cooperation this thesis will identify the factors which favour improvement of the northern roads system, and the evolution of more reliable and convenient services to northern communities and industry.

The results of this thesis will be available to any interested party at the address given above. I hope you will cooperate with me in this endeavor to provide a comprehensive analysis of the important role the truck transportation industry plays in the continued social and economic development of the MacKenzie Valley.

Copies of the final report will be presented to the Edmonton Chamber of Commerce and interested departments in the federal and territorial governments. In the end the report may assist these agencies in improving conditions for northern trucking operations. The results of this report and any subsequent action should benefit all members of the trucking industry and the customers served.

Thank you for your time and cooperation.

Yours truly,

David R Podmore

David R. Podmore

David R. Podmore
DEPARTMENT OF GEOGRAPHY
TELEPHONE (403) 432-3274

THE UNIVERSITY OF ALBERTA
EDMONTON, CANADA T6G 2H4

NORTHERN TRUCK TRANSPORTATION CLIENT SURVEY

Please complete the information below.

If there are any questions or difficulties I would be happy to offer any explanations or assistance you require.

(Edmonton 432-5626)

Client/Business; ______________________________
Address; ______________________ Phone; __________
____
____

Department or individual to address any future correspondence to;
____
____

1. What is your business? (e.g. retail food sales, equipment repairs, aircraft parts, etc.) ______________
____

2. Are your transportation requirements handled through;
a transportation broker ______________
an independent operator ______________
by your suppliers ______________
a scheduled freight line service ______________
other (please specify) ______________

3. What commodities do you most commonly receive by truck transport, and could you indicate these as a proportion (percent) of your total volume of shipments received?

Commodities received	Proportion of total freight volume received

4. What commodities (if any) do you most commonly ship "out" by truck transport, and could you indicate these as a proportion of your total volume of shipments discharged?

Commodities discharged	Proportion of total freight volume discharged

5. Where do most of the shipments you receive originate? (If more than one location indicate the relative importance of each.)

Point of origin	Importance
____________________	___
____________________	___
____________________	___
____________________	___
____________________	___

6. Where do most of the shipments you discharge from your operation terminate?

Point of termination	Importance
____________________	___
____________________	___
____________________	___
____________________	___
____________________	___

7. How many truck shipments per week do you receive on the average?
____________ truck shipments per week

8. What proportion of the truck shipments you receive are;

full trailer loads _______
less-than-trailer-loads _______

9. What would be the average content weight (1,000's lbs.) of truck shipments you;

receive __________ lbs.
discharge__________ lbs.

10a. Does your use of northern trucking services vary seasonally? ______
b. If so, which are your peak and low shipment seasons?

	Peak Season	Low Season
Months		
Major Commodities Shipped or Received		
Approximate Volume of Freight Received/ Discharged		

11. Do you receive trailers at your place of operations or do your shipments come via smaller local delivery services from a local freight office? ____________________________
____

12a. Do you make use of; On a regular basis?
" truck-air " services ______________

river barge transport	________	________
scheduled air freight services	________	________
non-scheduled air freight services	________	________
northern rail services	________	________

b. Between which locations? (e.g. Yellowknife to Coppermine)

	Origin	Destination
truck-air	________	________
barge	________	________
scheduled air freight	________	________
non-sched. " "	________	________
rail services	________	________

c. What type of commodities do you ship by;
truck-air ________________
barge ________________
scheduled air freight ________________
non-sched. " " ________________
rail services ________________

13a. Do you make shipments to customers in the MacKenzie Valley? ________

b. If so what proportion of your shipments to points in the MacKenzie Valley go by;
truck ________
air ________
barge ________

14a. Do you receive shipments from points in the MacKenzie Valley? ________

b. If so what proportion of all shipments you receive from points in the MacKenzie Valley come by;
truck ________
air ________
barge ________

15a. Are you happy with existing northern trucking services? ________

b. If not what complaints do you have? ________________

16. Do you think the present freight rates are reasonable? ________

17a. Do you think that northern truck transportation costs should by supported by a federal subsidy? ________________

b. Why? ________________

18. Are northern trucking services suitably coordinated with the schedules and services of other transportation systems in the MacKenzie Valley and Northern Alberta? ________________

19a. Are you satisfied with the present road network in the MacKenzie Valley and Northern Alberta? ______________________

b. Where would you expand or improve it? ______________________

20. I welcome any other comments you might have on the importance of northern truck transportation systems to your business and in the general context of northern development.

THANK YOU VERY MUCH FOR YOUR TIME AND COOPERATION

DAVID R. PODMORE

APPENDIX C

Alberta and Northwest Territories Motor Carrier Regulations

Alberta and Northwest Territories
Motor Carrier Regulations
1973

ALBERTA

Total License Fees:

72,000 lbs.	[illegible]
[illegible] lbs.	[illegible]
[illegible] lbs.	[illegible]
[illegible] lbs.	[illegible]
[illegible] lbs.	[illegible]

Or Maximum

Can refunds be obtained on License Fees?

Yes — Plates returned to the Board a refund may be granted equal to [illegible]% of original fee paid of the then current value of the plates. No refund after December 31st.

What dates are reduced fees permitted?

September 1st [illegible]% reduction; January 1st [illegible].

Height: 13½ feet; Car Trailer 13½ feet.

Length: 65 feet; Width: 102".

Number of Permits issued to American Carriers per annum:

6 Permits, for occasional operation or I.C.C. exempted goods only.

Number of Permits per company per annum: 6 Permits.

Cost of Trip Permits

Where trip mileage is 1 to 50 miles—$0.25 per 1,000 lbs. of net load
Where trip mileage is 51 to 150 miles—$0.50 per 1,000 lbs. of net load
Where trip mileage is 151 to 300 miles—$1.00 per 1,000 lbs. of net load
Where trip mileage is over 300 miles—$2.00 per 1,000 lbs. of net load
In any case, the minimum fee shall be $[illegible].

Hearings on basis of public necessity - Intra: Yes.
Extra Provincial: Yes.
Franchises: Yes.
Rates Filed: No.
Prescribed Rates: No.
Weights: Single Axle 18,000; Tandem 32,000; Maximum Gross 72,000; Tolerance Permitted 5% (except 72,000 lbs.); (on 72,000 lbs. 2,000 lbs. tolerance).
Where can license be obtained? All towns population over 200.
Main Issuing Office: Highway Traffic Board, Edmonton.
Official in charge:

C. J. [illegible], Chairman, Highway Traffic Board, New Highways Building Edmonton, Alberta.

Is C.O.D. Fidelity Bond necessary? Yes. One Vehicle $[illegible]. Up to 5 Vehicles $10,000 — Over 5 Vehicles $[illegible].
Is Cargo Insurance Compulsory? Yes.
In what amounts?

Not exceeding [illegible] lbs. $[illegible]; [illegible] to 20,000 lbs. $[illegible]; 20,001 lbs. to [illegible] lbs. $[illegible]; [illegible] to [illegible] lbs. $[illegible]; Over [illegible] lbs. $[illegible].

Is PL & PD Collision Insurance Compulsory? Yes.
Is Performance Bond required? No.
Gasoline Tax? [illegible].
Diesel Fuel Tax: [illegible].
Where can trip permits be obtained? Highway Traffic Board, Edmonton, and at Point of Entry.
Can Overweight Permits be obtained? Yes. On indivisible load if rail service not available.
Cost for overweight permits

Where trip mileage is 1 to 50 miles—$ 2.00 per ton of net overload
Where trip mileage is 51 to 150 miles—$ [illegible] per ton of net overload
Where trip mileage is 151 to 300 miles—$ [illegible] per ton of net overload
Where trip mileage is over 300 miles—$12.00 per ton of net overload

Maximum Gross Weight:

4 Wheel Truck 24,000 lbs. 2 axles 27,000 lbs. (where truck design permits).
6 Wheel Truck 38,000 lbs. 3 axles 41,000 lbs.
Tractor, Semi-Trailer 42,000 lbs. 3 axles 45,000 (where truck design permits).
Tractor, Semi-Trailer with Tandem Axle 48,000 lbs. 4 axles 58,000 lbs. permitted on certain designated highways.
Tandem Tractor and Tandem Semi-Trailers 5 axles 72,000 lbs. permitted on certain designated highways.

Maximum Axle Load: 18,000 lbs.
Maximum Tandem Load: 32,000 lbs.
5% Tolerance on all axles except 72,000 lbs.; (on 72,000 lbs. 2,000 lbs. tolerance)

NORTHWEST TERRITORIES

Total License Fee: 7301 lbs. to 10,000 lbs. - $[illegible]; For each additional 1000 lbs. or fraction thereof over 10,000 lbs. - $[illegible] per 1000 lbs. G.V.W. For a trailer registered in combination with a truck tractor - $[illegible].
License Year Begins: April 1.
Can Refunds Be Obtained: Yes. When plates are surrendered on or before October 31st, the refund is [illegible]% of the fee paid. Vehicles registered after October 31st shall be charged [illegible]% of the annual fee.
Height: 13'6"
Length: [illegible]' for single vehicle or [illegible]' in the case of a combination of vehicles.
Width: 102" (mobile homes - [illegible] ft.).
No. of Trip Permits Per Year: No limit, but carrier must have a N.W.T. operating certificate.
Cost of Single Trip Permits: 10% of the full annual registration cost.
Hearings: May be held at the discretion of the Highway Transport Board.
Franchises: No.
Filed Rates: Yes.
Prescribed Rates: No.
Gasoline Tax: 14c.
Diesel Tax: 18c.
Can Overweight Permits Be Obtained: Yes.
Cost of Overweight Permits:

1 - 25 miles —	$ 1.00 per ton
26 - 50 miles —	2.00 per ton
51 - 150 miles —	[illegible] per ton
151 - 300 miles —	[illegible] per ton
Over 300 miles —	12.00 per ton

C.O.D. and Fidelity Bond: Yes.
Cargo Insurance: Yes.
PL an PD Collision Insurance: Yes. $[illegible].
Where Can Licenses Be Obtained: Hay River, Pine Point, Fort Smith, Fort Simpson and Yellowknife, as well as at the weigh scales at Enterprise and most municipalities.

Note: Licenses can NOT be obtained from the R.C.M.P.

Main Issuing Office: Registrar of Vehicles - Ph. 873-[illegible]; Deputy Registrar - Ph. 873-7412; Chairman, Highway Transport Board - Ph. 873-[illegible]; Vice-Chairman - Ph. 873-[illegible]; Government of the Northwest Territories, Arthur Laing Building, Yellowknife, N.W.T.

Source: Alberta Motor Transport Association Directory -- 1973, pp.2-3.

APPENDIX D

Northern Motor Carrier Freight Rates

Northwest Territories Class and Volume Rates

BETWEEN: EDMONTON, ALBERTA and			Min. Chg.	CLASSES 100	85	70	55	(MINIMUM WEIGHTS) 10M	20M	30M	40M
672		Enterprise, N.W.T.	616	616	520	440	380	380	270	220	200
1000		Fort Chipewyan, Alta.	Contact Hay River Truck Lines Ltd. or Pacific Western Trucking Division for rates.								
780	xxx	Fort Providence, N.W.T.	690	690	582	515	404	404	[illegible]	[illegible]	[illegible]
907	xx	Fort Rae, N.W.T.	[illegible]	[illegible]	765	630	520	520	[illegible]	[illegible]	270
880		Fort Resolution, N.W.T.	[illegible]	[illegible]	765	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	270
986	x	Fort Simpson, N.W.T.	874	874	741	630	512	512	[illegible]	[illegible]	[illegible]
960		Fort Smith, N.W.T.	765	765	625	522	411	411	[illegible]	285	261
700		Hay River, N.W.T.	616	616	520	440	380	380	270	220	200
780		Pine Point, N.W.T.	690	690	582	515	404	404	345	285	215
995	x	Snare River, N.W.T.	[illegible]	[illegible]	765	[illegible]	520	[illegible]	[illegible]	[illegible]	270
930	x	Yellowknife, N.W.T.	[illegible]	[illegible]	766	[illegible]	520	520	[illegible]	[illegible]	270

Note 1: (x) Denotes that rates to this point are subject to Air Shuttle Rates, during spring break up when the N.W.T. Government states that the ice crossing on the McKenzie River is unsafe, until the ferry commences service, as follows: Min. $12.00, and $12.00 per cwt. If a road ban is in effect at the same time due to Spring break up the charges will be Min. $14.50 and $14.50 cwt.

Note 2: (xx) Denotes that rates to this point are subject to Air Shuttle Rates as stated in Note 1 plus local rates from Yellowknife.

Note 3: (xxx) Denotes that freight to this point will be dropped off at Carriers Terminals at Hay River at Hay River rates during restrictions referred to in Note 1.

Note 4: (x)Denotes rates to this point subject to negotiation with Carriers during Ferry closure.

Note 5: (xxx) From Edmonton to Fort Providence the following delivery charges will apply in addition to the rates shown:

1 to 200 lbs. .... Minimum Charge $2.50

Over 200 lbs. an additional charge of $1.00 per cwt.
10,000 lbs. and over .... No additional charge.

Note 6: During Road Ban Restriction the Minimum Rates will be the Class 100 rates on both Less Than Truck-Loads and Truckload movements. This will also apply to points North of the McKenzie River during periods when the ice crossing is capable of handling payload of 20,000 lbs. until the crossing is capable of handling full pay loads of 40,000 lbs.

Note 7: Rates under the 10M, 20M and 30M columns will only apply to freight weighing more than 15 lbs. per cubic foot. Freight weighing less than 15 pounds per cubic foot. The Minimum Charge in the 10M, 20M, 30M and 40M columns for a fully loaded trailer will be the charge for 40,000 lbs. at tthe 40,000 lbs. rate.

BETWEEN: GRIMSHAW and PEACE RIVER, ALTA and			Min. Chg.	CLASSES 100	85	70	55	(MINIMUM WEIGHTS) 10M	20M	30M	40M
362		Enterprise, N.W.T.	546	457	346	285	224	224	182	142	117
430	xxx	Fort Providence, N.W.T.	575	[illegible]	[illegible]	340	266	266	214	134	120
507	xx	Fort Rae, N.W.T.	603	568	506	420	[illegible]	[illegible]	264	180	178
580		Fort Resolution, N.W.T.	632	592	[illegible]	[illegible]	[illegible]	[illegible]	227	187	148
611		Fort Simpson, N.W.T.	638	568	512	420	271	271	[illegible]	204	166
565		Fort Smith, N.W.T.	575	537	447	[illegible]	[illegible]	[illegible]	237	188	151
395		Hay River, N.W.T.	546	432	[illegible]	297	232	232	181	147	131
456		Pine Point, N.W.T.	546	432	365	317	250	250	196	150	120
600	x	Yellowknife, N.W.T.	655	595	[illegible]	420	[illegible]	[illegible]	264	220	182

Note: Rates in this item subject to notes in Item 2020 except that the rates in Note 1 under that item will be:
During Air Shuttle Service - $10.67 Min. rate $10.67 cwt.

During Air Shuttle Service and Road Restriction $12.00 Min., rate $12.00.

BETWEEN: HIGH LEVEL, ALBERTA and		Min. Chg.	CLASSES 100	85	70	55	(MINIMUM WEIGHTS) 10M	20M	30M	40M
173	Enterprise, N.W.T.	518	278	233	183	152	152	126	98	78
253	Fort Providence, N.W.T.	546	342	280	228	187	187	154	119	98
300	Fort Resolution, N.W.T.	546	357	304	250	197	197	161	134	103
410	Fort Simpson, N.W.T.	575	420	374	307	242	242	198	152	128
200	Hay River, N.W.T.	518	294	251	206	162	162	132	102	86
230	Pine Point, N.W.T.	546	322	274	225	177	177	165	112	92
460	Yellowknife, N.W.T.	575	479	[illegible]	323	258	258	212	164	125

Note: Rates subject to revision during Road and Ferry Closing.

L.T.L. CLASS RATES AND TRUCK LOAD RATES:

BETWEEN: HAY RIVER, N.W.T. and		Min. Chg.	CLASSES 100	85	70	55	(MINIMUM WEIGHTS) 10M	20M	30M	40M
105	Fort Providence, N.W.T.	518	242	200	170	133	133	100	84	70
300	Fort Rae, N.W.T.	546	322	274	225	177	177	165	112	92
100	Fort Resolution, N.W.T.	518	296	251	206	162	162	132	102	86
200	Fort Simpson, N.W.T.	546	342	280	230	187	187	154	119	98
175	Fort Smith, N.W.T.	518	270	225	180	132	132	126	98	78
60	Pine Point, N.W.T.	460	180	150	122	104	104	80	68	54
210	Yellowknife, N.W.T.	546	373	316	261	205	205	168	130	107

Note 1: Charge for loading and unloading Rail cars, is extra.

Note 2: Rates subject to revision during Road Restrictions and Ferry Closing. During time of Ferry closing the Minimum Charge to Yellowknife will be $8.25 and $8.25 cwt.

Source: Alberta Motor Transport Association Directory -- 1973, pp.88-89.

APPENDIX E

Response to Northern Trucking Client Survey

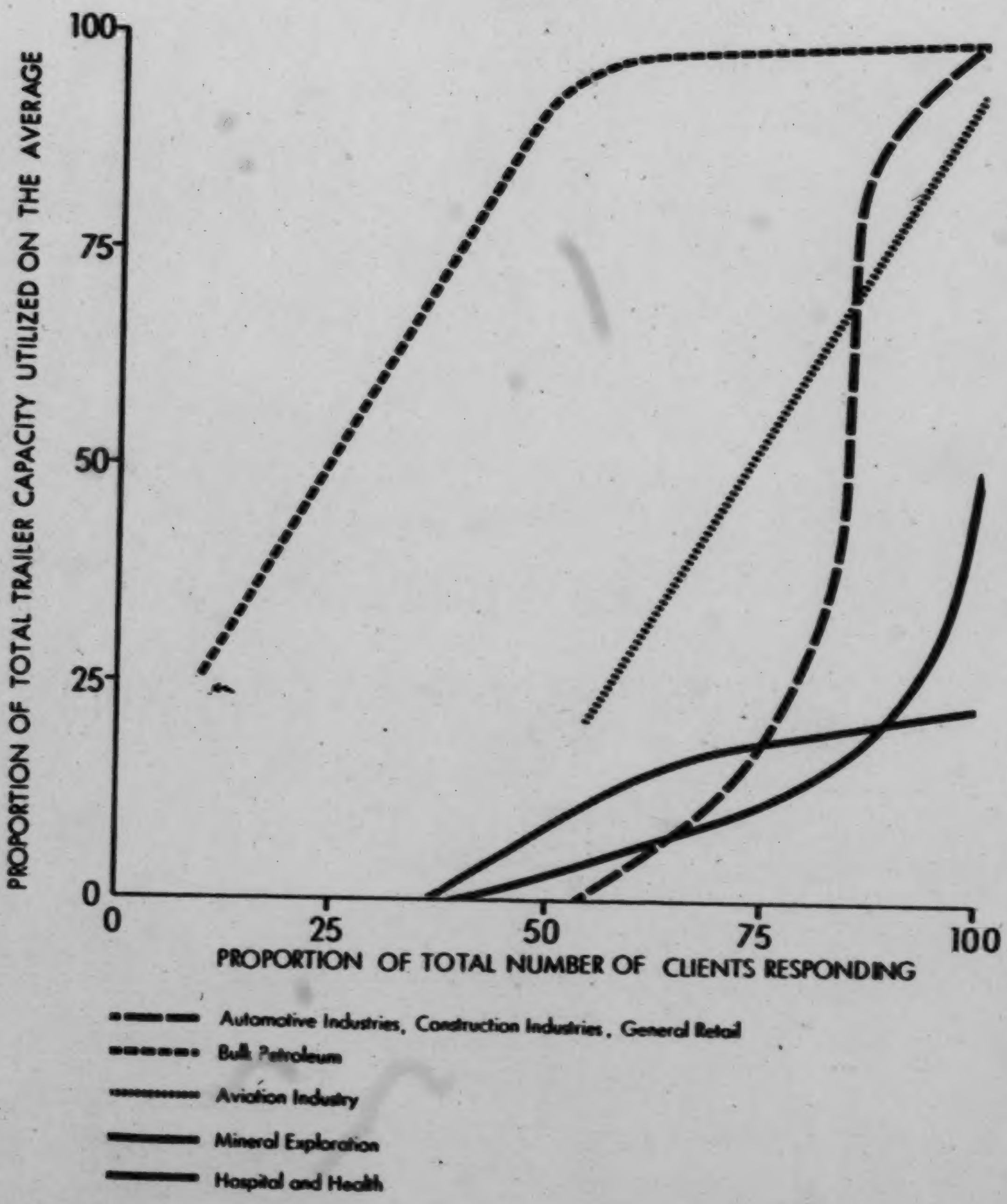
RESPONSE TO NORTHERN TRUCKING CLIENT SURVEY

Community	Type of Response Questionnaire	Interview	Estimate	Total	Percentage of Total Response
Yellowknife, N. W. T.	49	8	2	59	21.8
Fort Rae	4	-	5	9	3.3
Fort Providence	1	3	2	6	2.2
Enterprise	1	1	-	2	0.7
Fort Simpson	3	8	4	15	5.5
Hay River	17	14	9	40	14.8
Pine Point	8	-	2	10	3.7
Fort Smith	7	10	6	23	8.5
Fort Resolution	-	2	4	6	2.2
Echo Bay	1	-	-	1	0.4
Terra Mining	1	-	-	1	0.4
Rae Lakes	-	1	-	-	0.4
Lac La Martre	-	-	1	1	0.4
Snare River	-	1	-	1	0.4
High Level, Alberta	24	15	13	52	19.2
Manning	23	14	7	44	16.2
Total	139	77	55	271	
Percentage of Total Responses	51.3	28.4	20.3		100.0

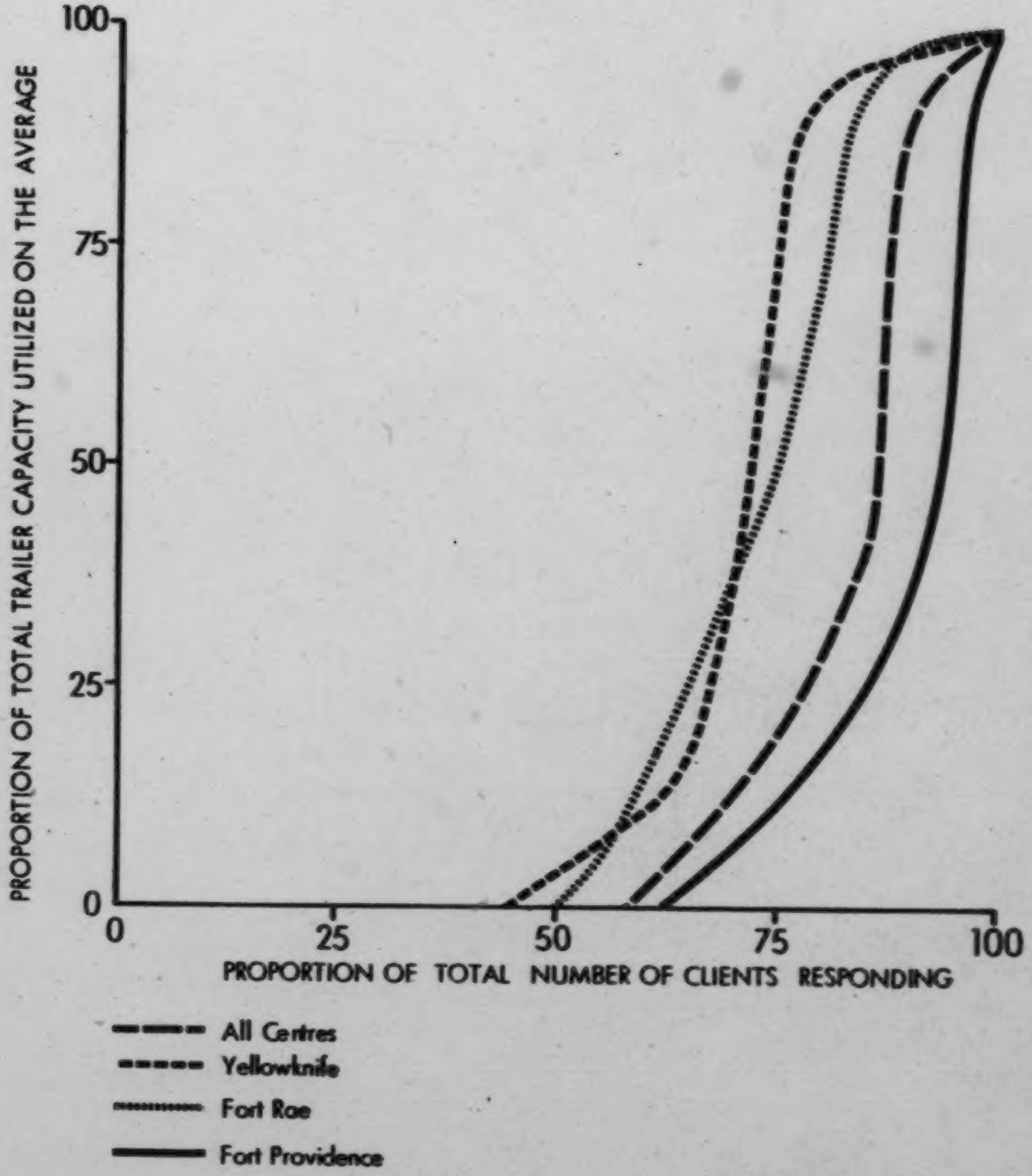
APPENDIX F

Truckload Traffic Characteristics
for Business Functions and Locations

TRUCKLOAD TRAFFIC CHARACTERISTICS FOR BUSINESS FUNCTIONS
1972



TRUCKLOAD TRAFFIC CHARACTERISTICS FOR BUSINESS LOCATIONS
1972



APPENDIX G

Standard Deviations for Average Size of Northbound Shipments

STANDARD DEVIATIONS FOR AVERAGE SIZE OF NORTHBOUND SHIPMENTS

LOCATION	(lbs) STANDARD DEVIATION FOR AVERAGE SIZE OF NORTHBOUND SHIPMENTS
Yellowknife	18019
Rae-Edzo	19124
Fort Providence	23918
Enterprise	28072
Fort Simpson	15525
Hay River	13811
Pine Point	16144
Fort Smith	22428
Fort Resolution	14322
High Level	12798
Manning	12042

APPENDIX H

Northern Water Shipments--Northern Transportation Company--1972

NORTHERN WATER SHIPMENTS
NORTHERN TRANSPORTATION COMPANY LIMITED
1972

Origin	Destination	Volume in Tons Bulk	General Freight
Peace River	Waterways	-	11607.0
	Other points	-	1471.5
Waterways	Embarass	248.0	1743.7
	Fort Chipewyan	1410.4	1396.1
	Bushell	15373.3[a]	4449.8[a]
	Other points	978.1	1613.0
Norman Wells	Fort Resolution	-	-
	Hay River	3167.2	804.6
	Yellowknife	6665.3	3.1
	Fort Simpson	3332.0	295.9
	Fort Wrigley	-	295.1
	Fort Norman	655.8	341.5
	Fort Good Hope	2422.9	571.5
	Arctic Red River	681.6	95.0
	Fort McPherson	3551.6	157.4
	Bear River	342.4	60.2
	Great Bear Lake	4303.1[b]	460.8
	Other points	1560.1	1073.8
Hay River	Yellowknife	25069.0	15.0
	Snowdrift[c]	463.8	270.2
	Fort Simpson	2687.9	19.0
	Fort Wrigley	721.7	1821.6
	Fort Norman	-	768.4
	Norman Wells	5025.5[d]	4880.9[d]
	Fort Good Hope	1296.2	3956.8
	Fort Franklin	-	451.3
	Great Bear Lake	1089.6	608.9
	Arctic Red River	1776.5	2031.3
	Fort McPherson	1952.3	4057.7
	Aklavik	1949.7	2217.3
	Inuvik	19617.6	25079.4
	Tuktoyaktuk	14755.7	4417.6
	Other points	3402.4	5779.8
Special Movements[g]		21069.9	-
Totals		143667.7	82788.2

Grand total all points in the Mackenzie Valley Area[h] .....226455.9 tons

Source and Notes: Pers. interview, D. S. Robinson, Traffic Manager, Northern Transportation Company, Edmonton, 10 October 1973.

Pers. communication, W. R. Fenton, Warehouse Superintendent, Eldorado Nuclear Ltd., Eldorado, 22 October 1973.

Pers. communication, R. H. Teskey, Field Services Manager, Imperial Oil Ltd., Calgary, 5 September 1973.

[a] Shipments to Eldorado Nuclear Ltd. (12,565 tons),

[b] Shipments to Echo Bay Mines Ltd. and Terra Mines,

[c] Includes shipments to Fort Reliance (about 120 tons),

[d] Shipments to Imperial Oil Company Refinery (approx. 4,990 tons bulk, and 4,771 tons general freight),

[e] Includes 10,108.2 tons bulk fuel and 480.9 tons general freight handled for the United States Air Force,

[f] Mainly, shipments to small native settlements or exploration sites,

[g] Oil supplies for Shell Oil, Pacific Petroleum, Gulf Oil, PanCana Industries, Western Geophysical, and Globe Oil, exploration operations in the Mackenzie Valley,

[h] More than 398,640 tons of traffic were handled by the Northern Transportation Company in the Mackenzie Valley and the Western Arctic during 1972.